

# Encyclopedia of



HEALTH



BEHAVIOR



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NORMAN B. ANDERSON, PhD  
Editor in Chief

Encyclopedia of  
HEALTH  
&  
BEHAVIOR

# Encyclopedia of HEALTH & BEHAVIOR

# 1

Editor in Chief  
NORMAN B. ANDERSON, PhD  
American Psychological Association

A Sage Reference Publication



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# Introduction

## RATIONALE

The field of health and behavior addresses the interaction of behavioral, psychological, emotional, social, cultural, and biological factors with physical health outcomes, such as heart disease, cancer, arthritis, diabetes, and chronic pain. The core philosophy of the field of health and behavior is threefold: (1) Behavioral, psychological, emotional, social, cultural, and biological factors are inextricably linked; (2) these factors together affect health; and (3) these factors can be used as avenues for prevention, treatment, and rehabilitation. Research and clinical practice in health and behavior are inherently multidisciplinary—that is, many disciplines contribute and no one discipline owns the field. Disciplines involved in health and behavior include psychology, epidemiology and public health, sociology, nursing, medicine, and anthropology, to name a few.

The field of health and behavior research is vast and ranges from the scientific examination of basic behavioral and social processes to the evaluation of preventive and treatment approaches to policy analysis. It addresses such varied topics as pain management, cardiac rehabilitation, social aspects of genetic testing, anxiety and heart disease, prevention of HIV/AIDS, stress effects on the immune system, approaches to smoking cessation, chronic disease management, community interventions, and socioeconomic status and health.

Health and behavior research has grown dramatically and has had increased visibility since the early 1980s. This growth is evidenced by a significant increase in the number of published scientific articles and books on the topic; the increase in funding for health and behavior research at federal and private funding agencies; and the appearance of health and behavior topics such as diet, exercise, smoking, and stress in popular publications and in electronic media. The growth, status, and potential of the field of health

and behavior were recently affirmed by two landmark reports from the National Academies: the Institute of Medicine's *Health and Behavior: The Interplay of Biological, Behavioral, and Societal Influences* (2001, Washington, DC: National Academy Press) and the National Research Council's *New Horizons in Health: An Integrative Approach* (2001, Washington, DC: National Academy Press). The 1995 opening of the Office of Behavioral and Social Sciences Research (OBSSR) at NIH is another example of the growth of the field. The OBSSR works across all of the institutes and centers of NIH to advance health and behavior research and other relevant areas.

Despite the tremendous growth and visibility of research on health and behavior, there existed no single reference source that captured the diversity and the multidisciplinary and transdisciplinary nature of the field and that was concise and accessible to lay audiences. The *Encyclopedia of Health and Behavior* was designed to be that reference source. The encyclopedia was designed to provide an introduction to the many topics in health and behavior for diverse audiences including undergraduate and graduate students in the behavioral and social sciences, medical students and those in the biomedical sciences, lay audiences (e.g., journalists, librarians, general public) seeking a nontechnical resource on health and behavior, and health scientists and practitioners who desire a quick reference source and introduction to areas outside their expertise.

## ORGANIZATION AND THEMES

The *Encyclopedia of Health and Behavior* is organized in an A–Z (alphabetical) format rather than by specific themes. In developing the topics that were to be included, however, the editors did rely on several different content areas or themes. These themes included, but were not limited to, the following:

- *Theories and methods in health and behavior* (e.g., the theory of planned behavior, health belief model, and multilevel methods theory)
- *Biopsychosocial interactions and basic behavioral and social processes* (e.g., behavioral genetics, psychoneuroimmunology, and cardiovascular reactivity)
- *Epidemiology of risk and protective factors* (e.g., the relationship to health and illness of factors such as diet, bereavement, acculturation, social capital, anxiety, social support, and stress)
- *Health promotion and disease prevention* (e.g., HIV/AIDS prevention, health promotion in schools, tailored communications, and church-based interventions)
- *Treatment and rehabilitation* (e.g., behavioral and psychological treatment of diabetes, drug abuse, fibromyalgia, asthma, headaches, and pain; doctor-patient communication; motivational interviewing; and adherence)
- *Policy and organizational issues* (e.g., health care costs and behavior, and health and behavior organizations)

Within the encyclopedia, considerable use is made of cross-referencing. That is, at the end of many of the entries there is information to guide readers to other related entries or further reading.

## EDITORIAL PROCESS

The editorial process began with the appointment of the six associate editors and six senior advisers. The members of these groups were selected because of their scientific leadership and vast knowledge of research on health and behavior. They also represented a number of disciplines, given the multidisciplinary nature of health and behavior. These individuals reviewed and revised a preliminary list of topics and potential headwords constructed by the editor in chief. The associate editors then selected Advisory Committee members, who also reviewed the preliminary topics and headword list and added potential titles. Many of these Advisory Committee members ultimately became contributing authors.

From the revised headword list, the associate editors and the editor in chief then identified and invited contributing authors to write the entries. Once entries were written and submitted, the associate editors were responsible for reviewing and editing these manuscripts.

Many of the associate editors also contributed entries themselves. Following the associate editors' review of the entries, they were submitted to the editor in chief for a final review.

## ACKNOWLEDGMENTS

I am fortunate to have had the opportunity to serve as editor in chief for this very special and first-of-its-kind publication. I wish to thank the Harvard School of Public Health for providing the ideal intellectual setting in which to work on this project. The volume would not have been possible without the encouragement, support, and guidance of Jim Brace-Thompson of Sage Publications, who believed from the start that an encyclopedia of this type would make a substantial contribution to the public health literature. Jim's expertise in behavioral and social science publishing, and especially in putting together encyclopedias, made my job so much easier. I am indebted to my managing editors, initially Mary Riso, and later Karen Ehrmann. They handled nearly all of the day-to-day work on the volume, including helping to identify and contact possible contributing authors, answering their many questions, prompting them to complete their entries, and ensuring that I stayed on task.

The associate editors cannot be thanked enough. These are all extraordinarily busy scientists and administrators who volunteered to spend a great deal of time on this project, when they could have been writing grant proposals or research papers. These people, because of their talent and expertise, are asked to do many things and are pulled in many directions. For them to take this on is a testament to their dedication to advancing the field of health and behavior. I will be forever grateful to them, as well as to our senior advisers and Advisory Committee members.

Most important, I wish to thank the contributing authors. Like the associate editors, the contributing authors are scholars with much on their professional plates, and they could have easily turned down the offer to write an entry due to time constraints. But they too recognized that the production of the first encyclopedia devoted exclusively to health and behavior research, which would cut across all of the disciplines that compose it, was an important development for our field. This encyclopedia is the result of their incredible efforts and the research conducted by scores of scientists.

—Norman B. Anderson

# About the Editor

**Norman B. Anderson, PhD**, is Chief Executive Officer and Executive Vice President of the American Psychological Association (APA). Trained as a scientist and a practitioner, Dr. Anderson has dedicated much of his professional life to studying the relationships between health and behavior, and health and race. At APA, his priorities include bringing psychology's broad expertise to health care, the public, and policy-makers and expanding the role of psychologists in our nation's health care system, the workplace, and education.

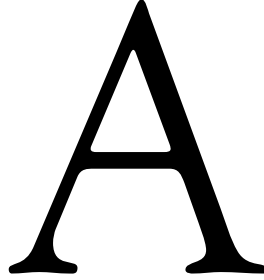
Prior to joining APA, Dr. Anderson was Professor of Health and Social Behavior at the Harvard University School of Public Health, where his interests centered on health disparities and mass media approaches to public health. He is also widely known as the first Associate Director of the National Institutes of Health (NIH) for Behavioral and Social Sciences Research, and the first Director of the NIH Office of Behavioral and Social Sciences Research (OBSSR). At NIH, he was charged with facilitating behavioral and social sciences research across all of the (then) 24 institutes and centers of the NIH. Under his purview was behavioral and social research in such areas as cancer, heart disease, mental health, diabetes, aging, and oral health.

Prior to going to NIH, Dr. Anderson was Associate Professor in the Department of Psychiatry and

Psychology: Social and Health Sciences at Duke University. There he studied the role of stress in the development of hypertension in African Americans and directed the NIH-funded Exploratory Center for Research on Health Promotion in Older Minorities. He received several awards for his research, including the 1986 New Investigator Award from the Society of Behavioral Medicine, the 1991 Award for Outstanding Contributions to Health Psychology from the APA, and a Research Scientist Development Award from the National Institute of Mental Health.

Dr. Anderson is a Fellow of the APA, the American Psychological Society, the Society of Behavioral Medicine, and the Academy of Behavioral Medicine Research, and he is a Past President of the Society of Behavioral Medicine. He has served as President of the Board of Directors for the STARBRIGHT Foundation of Los Angeles. He has also served on the Advisory Committee for Public Issues for the Advertising Council and chaired the National Academy of Science's Panel on the Future of Research on Race, Ethnicity, and Health in Later Life.

Dr. Anderson has published widely in the field of health and behavior and is author or editor of several books, including *Emotional Longevity: What Really Determines How Long You Live* (2003).



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## ACCULTURATION AND HEALTH

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The term *acculturation* has been used to describe the changes in cultural attitudes, values, and behaviors that occur upon contact between two formerly autonomous population groups, such as a colonized and a colonizer group, or an immigrant group and its host society. It is often assumed that only the culture of the subordinate (minority) group changes, while the culture of the dominant (majority) group does not change. However, some acculturation studies do acknowledge the bidirectionality of acculturation, that is, that both the minority and the dominant culture may change upon contact with one another (Redfield, Linton, & Herskovits, 1936; Social Science Research Council, 1954)

It has been noted that among immigrants, acculturation shows an association with health outcomes. This finding, along with the centrality of acculturation in the immigrant experience, has heightened interest in studying the effect of acculturation on health.

Importantly, the concept of acculturation refers both to how acculturated an individual is (acculturation as an outcome) and to the process through which an individual acquires the values, norms, and behaviors of the host culture (acculturation as a process). It has been hypothesized that both the degree of acculturation an individual has attained and the acculturation process he or she undergoes may affect health outcomes.

In the United States, acculturation has been examined primarily in relation to the health outcomes of immigrants. However, some studies have focused on

nonimmigrant minority groups such as African Americans, Native Americans, and Puerto Ricans. Here we discuss the research on immigrants since it constitutes the bulk of the U.S. literature on acculturation and health.

### ACCULTURATION AND ASSIMILATION THEORIES

Acculturation theory originated in anthropology in the 1930s. Anthropologists were originally interested in the changes experienced by colonized cultures upon contact with colonizer (i.e., dominant) cultures. Therefore, most anthropological research on acculturation has been conducted abroad. A new development in the field is the study of immigrants in the United States (Foner, 2000). Although health research has applied the anthropological concept of acculturation to the study of health outcomes among immigrants in the United States, it generally lacks a strong theoretical foundation. Critics have noted that acculturation is rarely defined in the health literature (Gutmann, 1999; Hunt, 1999).

Acculturation, defined as learning the language and cultural normative lifestyles of the host country, has been conceptualized as the first step toward assimilation, which also involves socioeconomic advancement, intermarriage, and the absence of prejudice and discrimination in the core society (Gordon, 1964; Portes & Rumbaut, 2000; Rumbaut, 1996). The classical sociological theory of assimilation predicted that immigrants would be absorbed into the mainstream of the host society. Recent theoretical developments in sociology (i.e., segmented assimilation theory) have



questioned the inevitability of assimilation into the mainstream, and proposed that integration is only one of several possible assimilation outcomes. These outcomes, which vary across immigrant groups, also include downward assimilation and biculturalism (Portes & Rumbaut, 2001).

Health research has focused on the role of acculturation (i.e., English-language acquisition, changes in values and norms) as opposed to structural assimilation. Only recently, a few health studies have begun to address socioeconomic factors, contextual factors, and discrimination in the host society along with acculturation (Arcia, Skinner, Bailey, & Correa, 2001). For instance, Harris (1999) examined whether family and neighborhood factors mediated the positive association between immigrant assimilation and poor physical/mental health and health risk behaviors. Finch, Kolody, and Vega (2000) showed that perceived discrimination and acculturative stress have independent effects on depression among Mexican-origin adults in California.

The focus on acculturation (as opposed to assimilation) in health research may be due to the link between acculturation and behavioral perspectives. Acculturation has been defined as behavioral assimilation. Health research has favored health behavior models, which emphasize the role of individuals in making lifestyle choices that are conducive to good health (Krieger, 2001). Health research on acculturation assumes that culturally based differences may explain differences in health behaviors among individuals from different ethnic groups (Hunt, 1999).

## ACCULTURATION AND HEALTH OUTCOMES

The role of acculturation has been examined in relation to diverse health outcomes including health behaviors (e.g., tobacco/alcohol use, unsafe sex practices), access to preventive health care (e.g., prenatal care, immunizations, dental care), health beliefs/attitudes (e.g., parenting beliefs), and infant/child health (e.g., low birth weight, infant mortality). A search on Medline conducted in June 2002 using "acculturation" as a MeSH subject heading generated 1,630 citations (1966-June 2002).

It has been noted that acculturation seems to have a detrimental effect on health outcomes, that is, more acculturated immigrants exhibit worse health outcomes than their less acculturated counterparts. For

example, this positive association between acculturation and poor health has been documented for alcohol use (Caetano & Mora, 1988), smoking (Perez-Stable et al., 2001), illicit-drug use (Amaro, Whitaker, Coffman, & Heeren, 1990), low birth weight (Cobas, Balcazar, Benin, Keith, & Chong, 1996), and immunization rates (Anderson, Wood, & Sherbourne, 1997). It should be noted though that a number of studies have found a negative association, no association, or a U-shaped association between acculturation and poor health.

Why is acculturation detrimental for some health outcomes? Some researchers have hypothesized that "immigrant status" (Harris, 1999) or a specific "cultural orientation" (e.g., Mexican; Scribner & Dwyer, 1989) may confer a protective effect on health. There are mechanisms by which increased acculturation may worsen health (e.g., via reduced social support as recent immigrants may have stronger social networks). However, there are also mechanisms by which acculturation may improve health (e.g., through better access to health care as immigrants' chances of having health insurance may increase with length of stay in the United States). The possible mechanisms by which acculturation may influence health outcomes are often not discussed or tested in the literature.

Various outcomes show different associations with acculturation. For instance, while several studies found that acculturation is a risk factor for smoking (Perez-Stable et al., 2001), others showed that access to health care improves with increased acculturation (Solis, Marks, Garcia, & Shelton, 1990).

Also, for a given outcome the association with acculturation often varies by ethnic/national origin group. For example, acculturation seems to be positively associated with tobacco use among Hispanics (Perez-Stable et al., 2001). Among Asian subgroups, studies have reported both a positive (e.g., among Chinese; Chen, Unger, & Johnson, 1999) and a negative (e.g., among Vietnamese; Wiecha, Lee, & Hodgkins, 1998) association between acculturation and smoking.

As noted earlier, acculturation refers to both a process and an outcome. Some studies have focused on the stress associated with the process of acculturation. For example, Perez (Perez M, Pettit, & Joiner, 2002) showed that the interaction between acculturative stress and body dissatisfaction predicted bulimic symptoms.

## ACCULTURATION AND THE HISPANIC PARADOX

Overall, researchers have found a positive correlation between socioeconomic status and health outcomes. Although Hispanics tend to be poorer, less educated, and medically underserved compared with non-Hispanic Whites, they often have similar health outcomes. The term “epidemiologic paradox” refers to this unexpected finding.

It has been hypothesized that the Hispanic paradox may be attributed to the protective effects of immigrant status, which may be mediated by acculturation. Several studies have found more favorable pregnancy and infant mortality outcomes among foreign-born mothers of Hispanic descent than among U.S.-born mothers of Hispanic descent (Franzini, Ribble, & Keddie, 2001). Scribner (Scribner & Dwyer, 1989) proposed the “acculturation hypothesis” suggesting that a group-level effect for cultural orientation is more important in determining the risk of chronic disease among Mexican Americans than genetic, biological, or socioeconomic factors at the individual level.

## INTERACTION BETWEEN ACCULTURATION AND DEMOGRAPHIC AND SOCIOECONOMIC FACTORS

Some studies have examined whether the effect of acculturation is explained or modified by other factors.

### Gender

Research has shown that the effect of acculturation on health is different for males than for females. For instance, it appears that acculturation increases the risk of smoking more among females than among males (Epstein, Botvin, & Diaz, 1998; Marin, Perez-Stable, & Marin, 1989; Shankar, Gutierrez-Mohamed, & Alberg, 2000). These findings are consistent with some sociological studies that suggest that acculturation is a gendered process. Immigrant girls are more likely than immigrant boys to have hyphenated ethnic identities (e.g., African-American, Hispanic-American), to experience low self-esteem and depression, and to have conflict with their parents (Rumbaut, 1996).

## Socioeconomic Status

The evidence on whether acculturation has an effect on health after taking into account socioeconomic status (SES) is mixed. For example, Prislin, Suarez, Simpson, and Dyer (1998) found that even after accounting for SES and demographic factors, more acculturated Mexican women in Texas are less likely to have their children adequately immunized. Some studies have suggested that acculturation may interact with SES. For example, education may have a protective effect among more acculturated individuals but not on less acculturated individuals.

## Access to Health Care

In several studies, access to health care appeared to be positively associated with acculturation (Ismail & Szpunar, 1990), even after controlling for health insurance status, which suggests that either English-language proficiency or increased familiarity with the U.S. health care system may be at work.

Other research found that access to health care (having a routine place for health care, health insurance coverage, and a regular provider) may account for the effect of acculturation on health (Solis et al., 1990).

## ACCULTURATION MEASURES AND SCALES

Operationalizing and measuring acculturation in health research has been elusive. Researchers rely on proxies for acculturation such as immigrant generation status, length of stay in the United States, and English-language use. The use of proxies for acculturation may be problematic. For instance, when immigrant generation is used as a proxy for acculturation, the finding that second-generation immigrants (i.e., U.S.-born individuals of foreign-born parents) have worse health outcomes than first-generation immigrants (i.e., foreign-born individuals) is interpreted as an indication that acculturation has a detrimental effect on health. An alternative explanation, though, may be that first-generation immigrants are selected for good health.

Instead of relying on demographic proxies for acculturation, some studies have used acculturation scales. One of the better-known acculturation scales developed for health research is Hazuda's, which is

divided into five acculturation subscales (covering English-language use and presumed Mexican cultural values) and two “structural assimilation” subscales (covering ethnicity of social networks) (Hazuda, Stern, & Haffner, 1988). Also, a few acculturation scales have been developed for Asians (e.g., Southeast Asians; Anderson et al., 1993; and Filipino; dela Cruz, Padilla, & Butts, 1998).

## LIMITATIONS OF ACCULTURATION AND HEALTH RESEARCH

In the United States, generally, nationally representative health surveys have only limited information on immigrant status (Loue & Bunce, 1999). In addition, most health surveys are cross-sectional, which limits researchers’ ability to examine the process of acculturation. There are very few nationally representative longitudinal health surveys with information on immigrant status (the Adolescent Health Survey is one of them).

To date, only a few U.S. national health surveys have included acculturation scales. The 1982-1984 Hispanic Health and Nutrition Examination Survey (HHANES) included an acculturation scale composed of eight items covering language use/preference, ethnic identification of self and parents, and birthplace of self and parents. In 1987, 1992, and 2000, a cancer supplement questionnaire administered to an adult subsample of the National Health Interview Survey (NHIS) included the same questions on Hispanic acculturation as the HHANES.

Often studies of acculturation and health focus on a single state/community, a single national origin/ethnic group, and/or convenience samples. Therefore, the resulting empirical evidence is fragmentary.

Rarely do acculturation and health studies control adequately for SES and access to health care at the individual level, and even more rarely for family and neighborhood factors. Instead of acknowledging these data limitations, residual effects are often attributed to “culture.” A similar problem exists in relation to English use/proficiency variables, since it is unclear whether the effect of English-language use/proficiency should be interpreted as a cultural factor or as an access factor.

Different associations between acculturation and health outcomes have been documented for various national origin groups. However, acculturation and health research has not adequately addressed whether

the causes of these variations across immigrant groups are due to socioeconomic, cultural, or contextual factors. Further research on the role of gender in moderating the effect of acculturation on health is also warranted.

Finally, critics have noted that in health research, acculturation is assumed to be a unidirectional process (i.e., only the minority culture is influenced by the hegemonic culture). Biculturalism is largely ignored, although in other disciplines, for example, sociology, recent theories such as segmented assimilation postulate that it may have a protective effect. Furthermore, in health research, acculturation is implicitly taken to represent modernization. Two analytically separate cultures are assumed: the mainstream one (modern) and the ethnic one (traditional). Health behaviors based on rationality/responsibility are ascribed to the mainstream culture, while behaviors based on irrationality/irresponsibility are ascribed to “ethnic” cultures (Gutmann, 1999; Hunt, 1999).

—Dolores Acevedo-Garcia

See also CULTURAL FACTORS AND HEALTH

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## ADHERENCE TO TREATMENT REGIMENS

Adherence, also known as compliance, to treatment regimens refers to the degree to which a patient's management of his or her daily regimen corresponds to the regimen prescribed by the health care provider. Thus, if a patient is prescribed one pill twice a day and takes one pill twice a day, the match between behavior and prescription is 100%—adherence is 100%. If that same patient takes one pill once a day, the match is accurate 50% of the time—adherence is 50%. Similarly, if the patient is prescribed exercise three times a week for 30 minutes but exercises once a week, that patient would be 33% adherent.

Problems with adherence to treatment regimen have been known for centuries. Indeed, Plato commented on poor adherence to recommended treatment based on observations made while accompanying his physician brother on patient visits. Efforts to study adherence to medical treatments began in earnest in the late 1960s, with studies of interventions beginning in the mid-1970s. The first conference on patient adherence (compliance) was held in Canada in the mid-1970s. Since that time considerable effort has gone toward understanding this phenomenon and to a lesser extent to exploring strategies to remediate it.

Adherence problems may arise with any treatment regimen. Indeed, adherence rates to medication, diet, and exercise regimens have all been reported to average about 50%. This reflects substantial deviation from optimal therapies, a deviation that results in more than \$150 billion in added costs annually (Grahl, 1994); the added costs are the result of additional treatment requirements, preventable hospitalization, management of disabilities, and the burden of early retirement.

In addition to added costs to the health system, poor adherence may have significant negative clinical consequences. Poor adherence has been associated with disease progression and with the development of

complications. It has even been associated with loss of transplanted organs and death. Furthermore, poor adherence has been associated with the development of treatment-resistant organisms in such conditions as HIV/AIDS, ear infections, and tuberculosis. Failure to adhere to immunization recommendations has been associated with preventable disease, such as measles. Undetected poor adherence prevents the assessment of treatment adequacy and clinical efficacy. This often results in changes in treatment or in treatment dosing.

Poor adherence not only has a negative impact on clinical outcomes, it also has a negative impact on clinical trials. When subject adherence is low in research, larger sample sizes are required to provide adequate power to evaluate treatment efficacy. This can significantly increase the cost and time to complete studies. Where this compensation is not done, treatment effectiveness may be underestimated. Poor adherence may reduce the ability to detect side effects from treatment, thus overestimating safety and/or underestimating risks or adverse effects. Thus, poor adherence has the potential to mask true evaluations of new treatments, thus impacting treatment itself.

## PATTERNS OF POOR ADHERENCE

Deviation from the prescribed treatment, or poor adherence, may take many forms. First is the failure to initiate the regimen at all. Multiple reasons account for this decision. Patients may not believe in the necessity or effectiveness of the treatment or may not believe that they need treatment at all. Other patients worry about the risk of side effects or adverse effects. Still others are concerned about the costs of treatment or its accessibility.

A second form of deviation from treatment is stopping a treatment too early. Multiple reasons account for this behavior. Patients may stop treatment because they feel better or believe that they no longer need treatment. Others may stop because of the accessibility of continued treatment. Still others may experience untoward effects associated with the treatment. An additional factor is a lack of clear understanding of the need to persist with treatment.

Other patients may not stop the treatment altogether, but may miss doses of treatment. This is perhaps the more common form of poor adherence. Treatment may be missed episodically or the patient shows a predilection for certain doses to be omitted. For medication this may be reflected in certain times

of day or certain days of the week. For example, medications to be taken at lunchtime or during social events or on weekends have a higher risk of omission. For dietary programs certain meals or days may be most at risk. Days of the week may also be a factor in missed exercise episodes. Missed episodes may lead to whole days or sets of days without treatment. If three consecutive days or more are missed, the period is referred to as a holiday. The most commonly reported reasons by patients for such episodes include forgetting, disruptions in the routine, irregular lifestyles, busyness, and inconvenience, particularly for medication management. Alterations in routine, busyness, distractions, inconvenience, time required, social situations, inadequate knowledge, lack of awareness, and side effects have all been reported by patients as contributors to errors in regimen management. Other factors may play a role as well, such as the belief that periods off treatment are beneficial or that less treatment than that prescribed is sufficient.

Patients may also lower the dose of treatment. They may reduce the number of pills taken or the number of bouts of exercise or the extent to which a diet is modified. Multiple factors influence this action. Patients may not fully understand treatment. The support network may undermine adequate adherence. The patient may feel better on lower doses of treatment. Costs may be lower. Fully participating in treatment may not be convenient or accessible.

Conversely, the patient may also increase the dose of treatment. Extra pills may be taken; overexercise may occur; excessive dietary restrictions may be enacted. Less is known about reasons for overconsumption. For some patients, this may occur to self-manage symptoms. For others, beliefs about treatment may underlie regimen alterations. Not uncommon is taking make-up doses of medication when the patient forgets whether or not medication was taken.

Timing errors represent a common deviation from the prescription. Medication prescribed twice a day may be taken 3 or 4 hours apart with the next dose 20 or 21 hours later. Exercise bouts may be clustered on the weekend rather than distributed throughout the week. A common reason for timing errors is a lack of understanding or information about effective timing. Another reason for this type of adherence problem is the inconvenience of carrying out the treatment at appropriate times.

Perhaps the most common type of poor adherence is a combination of the above problems, leading to an

erratic pattern of adherence. The reasons for poor adherence may change from time to time. Often the patient is unaware of the extent of the problem of poor adherence that is present.

Last, patients may make technical errors that could be conceived of as adherence problems, but might better be labeled as performance errors. For example, a patient with asthma may be prescribed an inhaled medication to be given four times a day, three puffs per time. The doses and the timing may occur correctly, but the patient may be unaware of the need to leave a time between puffs to enhance the effectiveness of the medication. Similarly, patients may make errors in the estimation of portion sizes in efforts to follow a calorie-restricted diet. Often these errors are due to poor understanding or a lack of thorough education by the provider.

Many other factors have been associated with poor adherence. For example, a number of studies have reported that early adherence to the treatment regimen is predictive of longer-term adherence. For the most part, demographic factors have not been predictive of adherence, with some variation from study to study. Social support has been found to have both positive and negative relationships with adherence. Selected health beliefs have demonstrated associations with level of adherence. The data for mood and personality dimensions remain inconclusive, although there are a number of reports that depression and low conscientiousness may be associated with poorer adherence. One of the difficulties in establishing firm associations is that the majority of studies have measured adherence through self-report, a measure that has been found to have significant and biased error. Very few studies have examined factors associated with poor adherence using more accurate measurement of adherence.

## MEASUREMENT OF ADHERENCE

Measurement of adherence has formed a core area of study in adherence. Advances in our understanding can be directly related to advances in measurement. In the 1960s, attention was focused on examination of self-report versus empirical observations. There was interest in the ability of the clinician to identify poor adherence. These studies failed to show that the clinician was able to do this. In the 1970s, increasing attention was given to biochemical assays and to the beginning development of monitors. The biochemical assays were shown to be affected by a host of individual characteristics and not to be particularly informative about adherence, particularly

adherence over time. In the 1990s, increased focus was placed on the development and utilization of a variety of electronic event monitors. Of interest at this time is the accuracy of these measures and their utility in research and clinical practice.

As noted, adherence can be measured in a variety of ways. The most common method over time has been the self-report. When compared with other measures, self-report has been shown to overestimate adherence and to significantly underestimate the number of poor adherers in a population. Self-report may be influenced by the demand characteristics of the research or clinical interaction, the structure of the self-report measure, the tendency to report "good" behavior, failure to remember events, and the tendency to estimate longer-term behavior based on recent behavior.

Other methods of assessment include examination of drug levels or biological indicators, for example, cholesterol levels, weight, and blood pressure. Unfortunately, these clinical indicators do not bear a strong relationship with more accurate measures of adherence nor do they permit an examination of the degree of adherence over time. They are influenced not only by adherence but also by adequacy of the regimen, treatment interactions, metabolism (of drugs), and other individual characteristics. They are not particularly accurate measures of assessing adherence.

The method considered to be most accurate at this time is the electronic event monitor. Electronic event monitors are available for medication taking, dietary recording, exercise, and diary recordings. In at least two investigations, the electronic event records were the only assessment strategy associated with clinical outcomes. This method tends to be more expensive than the self-report or biological assays. It is, however, particularly useful for research studies where greater precision in the estimate of adherence is needed and in clinical situations where there is a concern that a lack of clinical outcome is due to poor adherence but other measures are not detecting it.

## STRATEGIES TO IMPROVE ADHERENCE

Strategies to improve adherence to prescribed regimen have been of interest for nearly three decades. Yet much of the research has been devoted to the study of predictors and to assessment. Limited numbers of studies have been undertaken to examine, through randomized controlled investigations, how adherence

can best be improved. The majority of the work on adherence improvement has been done in the area of medication taking, where more than 500 investigations have been reported. Just 33 of these trials met adequate research design criteria (randomized clinical trial) and examined both adherence and clinical outcome over a 6-month or longer period (Haynes, McDonald, Garg, & Montague, 2002). Nearly half of these reported improvement in medication adherence, using primarily self-report or biological assessment, with 89% of those reporting improved clinical outcome. Studies focused on adherence improvement in behavioral interventions have received limited attention. A major concern regarding the intervention studies is that for the most part measurement of adherence has been through self-report.

The strategies that have been examined have had little impact on the population of patients in clinical care. The rates of adherence have changed very little in the nearly 30 years that intervention research has been conducted. This may be for a variety of reasons. The effect sizes of intervention studies are not large. The use of less accurate outcome measures may steer practice in erroneous directions. Issues of translation to practice sites have not been adequately addressed.

Even though there is a need for further testing of adherence intervention strategies, there are general measures that can be derived from the studies that have been done that appear useful: tailoring the regimen to patient routines, ongoing contact, adequate instruction in the treatment, self-monitoring, and the use of varying reminders. Continued research will help refine these and suggest new strategies.

## SUMMARY

There has been a substantial investment in adherence research by clinicians and researchers over the past 30 years. Yet, as noted, there is a considerable amount of knowledge to be gained from further study. The significance of the problem suggests that it is important to pursue that added knowledge. Refinements in measurements, increased specificity in predictors or correlates, and testing of new interventions show promise in improving a problem that affects approximately one half of patients in clinical care.

—*Jacqueline Dunbar-Jacob*

*See also AIDS AND HIV: ADHERENCE TO MEDICATIONS IN PERSONS WITH HIV INFECTION*

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## ADOPTION OF HEALTH BEHAVIOR

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*Health behaviors* are personal acts that raise or lower the risk of illness or injury. Behaviors that are performed predictably and often are called *habits*. Psychologists seek to understand health habits by viewing them as organized *systems*, composed of highly routinized sequences of actions, consequences, and reactions that lead to a predictable result. For example, dietary habits involve frequently practiced routines, each of which consists of a familiar sequence of behaviors, such as shopping for groceries, planning and preparing meals, and enjoying food in family or other settings. These routines can be viewed as consisting of functional feedback loops in which each behavior in the sequence is strengthened by the consequences it produces, and those consequences, in turn, then set the stage for the next behavior. In the present example, the act of leaving work and stopping at a grocery store on the way home is reinforced by the satisfaction of gathering needed food items, which then enable the hungry shopper to prepare a meal.

Preparing and sharing a meal often are accompanied by other activities, such as enjoying the company of friends or family members, which, by increasing the pleasure of eating, may lead to overindulgence. Efforts to alter diet or curb overeating must identify new actions and new outcomes to replace the usual eating routines.

Health behaviors tend to become *habitual* when they produce effects that are felt to be positive, are experienced reliably and often, and mesh with the routines of other persons with whom one interacts. Therefore, the most effective way to eliminate a health-damaging habit is to replace it with a health-protective habit that can occur in the same setting, requires similar or less effort, yet produces comparable effects. The first step in health behavior change involves analyzing a health-damaging habit in terms of its action system components (settings, actions, consequences) and identifying an alternative habit and action system components to encourage in its place. For example, those who want to lose weight by limiting consumption of high-calorie snacks might be advised to start by analyzing where, when, how, and why they snack and then to identify low-calorie snacks that could be consumed in the same situations, in similar ways, and with comparable levels of enjoyment.

Here we uncover the Achilles' heel of health promotion: A failure to experience a desired benefit fairly soon after performing a new health behavior lowers the likelihood that the new behavior will become a habit. The great and enduring challenge in health habit change is to ensure that desired consequences will be experienced, immediately and often, whenever and wherever the desired health behavior is performed.

The interpersonal environment plays an important role. Negative reactions by friends or family members can make it difficult to establish new health-protective patterns. The degree of "action linkage," or the extent to which two people's routines are interconnected, determines how disruptive the behavior change will be for both, and thus how difficult it may be to sustain the routine over time.

So how do people change their habits? It is one thing to know what one should do. But making a sustained effort to change is quite another matter. Several decades of research suggest that the process of change involves enhancing self-motivation, personal competence, and social support (Ewart, 1991, 2003).

People do not achieve sustained health habit change unless they believe that change is beneficial,



are capable of taking the necessary actions, and view habit change as compatible with important personal strivings or projects. Motivation to alter dietary habits derives, in part, from the judgment that eating differently will improve health or personal appearance and that such outcomes are desirable. These expectations may be enhanced through social modeling and exposure techniques. In the former, people are shown examples of individuals similar to themselves who enjoy the benefits of healthy behavior, or who suffer the ill effects of unhealthy habits. Direct exposure involves having the individual experience an outcome directly, as when children are given tasty fruit snacks to encourage their interest in healthy nutrition.

In addition to believing that a behavior change would be beneficial, people must feel personally capable of taking steps needed to achieve change. *Self-efficacy* refers to a person's level of confidence that he or she can take the necessary steps. Self-efficacy can be increased by performing an unfamiliar or difficult activity in gradually increasing doses, by observing people like oneself successfully perform the behavior, by verbal encouragement, and through interventions to manage physiological stress responses in challenging situations (Bandura, 1997).

A third motivational factor involves personal goals and strivings that shape one's day-to-day activities. These often involve life tasks such as achieving independence, establishing supportive relationships, pursuing a career, caring for children, maintaining a certain lifestyle, or coping with debility in old age. People are more likely to view a health behavior as desirable and feasible if the behavior is congruent with important personal strivings. Barriers to self-change can be lowered by helping people alter their projects and priorities. This may be achieved by identifying important strivings, clarifying ways in which different strivings or projects may conflict with one another, and considering how projects and health behavior changes might be made mutually supportive.

Why do attempts at self-motivation often fail? Even people who are highly motivated may fail to succeed in changing their habits if they do not formulate appropriate goals and plans. Motivational appraisals often fail to generate long-term change because people do not take the time to think through what they are trying to accomplish, anticipate difficulties, devise solutions, create plans, and set attainable goals. Therefore, in addition to motivation, self-change requires careful planning, problem solving,

and goal setting. People must learn to think flexibly and creatively about how to define the various challenges, anticipate difficult situations, brainstorm solutions, devise appropriate plans, and set attainable goals. Much of the difficulty in sustaining a new health habit over time involves remaining alert to potential problems, generating workable solutions, making plans, and setting goals.

These tasks call for two types of social competence. One type of competence involves knowing what one should do and why, whereas the other type of competence consists of practical know-how, or skill in performing specific actions needed to produce a desired effect. Together, these forms of competence enable one to comprehend, organize, retrieve, and apply information needed to make appraisals and solve problems.

Health education programs traditionally emphasized the teaching of health and illness "facts." Yet these efforts often failed to build practical behavioral skills that enable people to make decisions and act on their appraisals of the facts. Educational interventions must identify the types of behavioral skills that people will need when trying to implement their self-change plans.

Coping with relationship problems that result from habit change calls for *relational competence*, which involves partners' ability to understand and validate each other's goals and projects, and their willingness to manage conflicts either by coordinating goals (e.g., taking turns), compromising (e.g., each gets part of what they want), or resolving the conflict at a higher level. For example, the people involved may decide to focus on a shared, higher-order goal, as when partners agree to disagree on some issue in order to achieve harmony on matters of larger concern to both. Mutual understanding and validation are facilitated by communication skills such as reflective listening, sharing of feelings, and problem solving and are impeded by maneuvers designed to silence or hurt the other partner, and by withdrawal. Relationship-focused training in communication and problem-solving skills may be needed to help support the behavior change process.

How does the wider social environment affect people's ability to change patterns of behavior that affect their health? A person's social and economic status, education, and community environment have a major effect on health, in part because these factors affect one's ability to adopt new health behaviors (Gallo & Matthews, 2003). Neighborhood disorder,

crowding, violence, noise, temperature, and pollution have a variety of direct and indirect effects on people's capacity for self-protective action. These proximal environmental stressors and barriers threaten to disrupt the development and maintenance of self-protective health habits. Such environmental stress may deplete personal energy, reduce access to health information, and limit opportunities to engage in healthy pursuits such as regular physical exercise (Ewart & Suchday, 2002).

Community norms also play an important role in shaping health behavior. Norms function as rules of thumb that indicate the kinds of things one should do, or avoid doing, in pursuing one's goals. It is important, however, to distinguish between *perceived* norms and *actual* norms. People often base their actions (at least those actions that are publicly visible) on how they think others would behave, thereby conforming to a *perceived* norm of conduct, or public opinion. But the perception may not be accurate. Others may not support the perceived norm, or they may conform to it publicly while not endorsing it privately. This opens the possibility of influencing people's actions by altering their perceptions of publicly endorsed behavior codes, norms, and opinions.

Interventions to modify health behavior by altering social norms—or people's awareness of norms—have enjoyed some measure of success as components of educational programs to curb excessive alcohol use or discourage unsafe sexual activity. These interventions operate in part by altering perceived “public” norms for behavior in potentially unsafe situations.

Social networks and settings also influence individual behavior by exposing people to social models whose actions convey information about behavior-outcome contingencies, by providing opportunities to develop and sustain supportive relationships (i.e., to acquire relational competence), and by influencing biological conditions that facilitate or constrain action.

How does biology affect people's ability to change health habits? Biology can influence the adoption of health behavior by affecting personal and relational competence, and thereby shaping the ways people view their personal projects, perceive outcomes, appraise their capabilities, solve problems, and set goals. Biological influences include physical conditions such as fatigue or illness and states induced by the consumption of alcohol or other substances, as well as biologically based dispositions that are evident from birth as temperamental differences in activity, sociability,

and impulsivity. Together, biological and social influences combine to influence mood states, which can affect susceptibility to emotions such as fear, anger, sadness, joy, or pride, and thereby enhance or impede one's motivation to change. Negative emotions, as well as states of intoxication, may interfere with one's ability to recall health information, to envision effective forms of action, to judge the potential consequences of their actions, or to solve problems and envisage appropriate behavioral goals. Positive emotions, on the other hand, may enhance these activities. People who are emotionally distressed also have difficulty developing and maintaining close supportive interpersonal relationships that may facilitate self-change.

By now it should come as no surprise that there are a lot of questions about how best to improve the health of the public by helping people change their lifestyle habits. Many questions involve the process of change; for example, individuals differ in their readiness to change, and those who achieve success often do so after repeated failures. Some health psychologists would divide the process of change into a sequence of distinct stages, whereas others argue that the notion of fixed stages is not a valid or very useful concept. Other questions concern the relative feasibility and effectiveness of interventions that empower individuals to protect their own health, as opposed to interventions that reduce the need for personal self-protection by creating healthy environments.

Finally, there are many different theories and models of health habit change (Schneiderman & Speers, 2001). What is one to make of this conceptual profusion? Are controlled experiments needed to compare the various models, identify the best, and narrow the field? Or is such diversity appropriate, considering the multifaceted psychological, biological, social, and political dimensions of the behavior change process? Do we need a theory about how to evaluate, organize, and integrate the various health behavior theories (Ewart, 2003)? These questions and many others promise to keep behavioral scientists very busy in the years ahead.

—Craig K. Ewart

See also SELF-EFFICACY

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## AFRICAN AMERICAN HEALTH AND BEHAVIOR

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Over recent years, there has been an increasing recognition that behaviors, as well as the environmental contexts in which they are exhibited, are important to the conceptualization of the health of African Americans. Studies have begun to explore the dynamic relationship between behavior and health in an increasing number of diseases including cancer, diabetes, and asthma, while constantly integrating an increasing number of behaviors (smoking, eating, exercise, etc.). Few studies, however, have integrated into their conceptualization and empirical explorations the full range of contributory sociodemographic factors such as age, gender, race, and even psychosocial factors such as coping. Of these, race has certainly risen as one of the more complicated factors to define and evaluate. In particular, research on African Americans is often conducted with poor and unreliable operational definitions, and is conceptually void of an appreciation for the history and context of many of the behaviors that are frequently described. The current entry is designed to provide a brief historical context from which to better understand behavior in African Americans as it directly relates to health.

## HISTORY AND CONTEXT

The term *race* has historical roots in distinguishing humans based on ancestry and physical characteristics. *Race* is most often used to distinguish a population based on biological factors such as genetics, common descent, and physical appearance. For example, the Caucasoid race is often characterized as pale pinkish white to olive brown in skin color, of medium to tall stature, with a long or broad head, and of European ancestry. The Mongoloid race is often characterized as saffron to yellow or reddish brown skin color, of medium stature, and a broad head with Asian ancestry. The Negroid race is characterized by brown to brown-black skin, usually with a longer head, varying statures, and thick everted lips and African ancestry. Historically, race has been viewed as either a convenient mechanism for social and political classification or a useful and distinctive term that conveys salient information about biological predispositions and behavioral characteristics. More recently, the utility of *race* as representing distinct variance among groups of humans has grown into disfavor as having extremely limited utility, as not identifying unique intragroup genetic variance, and having limited scientific value. Many epidemiologists have suggested that *ethnicity* (biology + behavior + culture) may be a more accurate term.

The importance of race, particularly in American society and as exemplified by how we manage the construct, has undergone several distinct transitions over the years, but can be grossly divided into three eras. From the period beginning with slavery and extending into the 1950s, race was used as one of the most distinguishing characteristics of humans. Having a single drop of "Black" blood (any Black ancestors) was sufficient to identify a person as Black (one drop rule). During this time, very limited attention was placed on studying African American health because they were considered of little importance. Early medical researchers often failed to include African Americans because they were considered animalistic, property, and second-class citizens, if citizens at all. When they were included in research, they were treated as if their capacities were equal to or less than animals. Consent was almost never obtained and there was little regard for their comfort or long-term impairments including death resulting from experimentation. Race was thought to be associated with stereotyped genetic, behavioral, cognitive, and emotional

characteristics. For practical purposes this time is characterized as the “race is everything” era.

By the mid-20th century, culturally, America was initiating its journey toward equality of disposition and access. With the growth of the civil rights movement, America began to recognize that humans were born equal and that the concepts of “superiority” and “inferiority” were sociocultural constructions with little if any biological support. This recognition later led to an active and convenient minimization of the differences among races, due in part to a misassumption that “equality” and “same” were equivalent. The biopsychosocial functioning of Caucasians was thought to be the gold standard, and the degree to which individuals deviated from or were similar to this standard was the representative degree to which they were considered “normal” or “abnormal.” During this era, biomedical researchers again primarily focused on Caucasians with little emphasis on representing minorities and their uniqueness (African Americans, women, children, etc.) in studies. Consistent with the sociocultural activity of that time, research tended to downplay racial differences, if race was mentioned at all (Keefe et al., 2002). This second period of attention to civil rights and a convenient minimization of race is characterized as the “race is nothing” era.

Beginning in the late 1980s and in the context of a significantly diversified American culture, the importance of having racial and ethnic representation in biomedical research was elevated. Federally funded institutes began mandating representative samples, and the zeitgeist of the society shifted to recognize that humans could be different and alike, simultaneously. Furthermore, based on evidence from the human genome project and technological advances that allow for the detection of differences and similarities in genetic codes within humans and across other species, the recognition that “racial” groups may share more biological variance between them as compared to within them became popular. At the same time, it was also recognized that people have differences that are noteworthy and that these differences may contribute substantially to health outcomes.

During this era of “enlightenment,” American society also began to recognize the importance of understanding health in a more comprehensive context of historical experiences, psychosocial dispositions, and cultural influences in addition to biological factors. Consequently, to study health in African Americans,

and similarly Caucasians, is to study a system of behavior, thought, and emotion that is influenced by environmental interactions, historical experiences, and cultural forces.

The present entry will highlight this complex system of behavior, thought, and emotion using a cognitive-behavioral frame as it relates to disease in African Americans.

## HIV/AIDS

The prevalence of HIV/AIDS in African Americans is clearly different from other U.S. populations. African Americans account for approximately 38% of all AIDS cases reported in the United States, despite comprising only about 12% of the U.S. population. The rate of infection also appears to be higher among African Americans as compared to others, with a rate 8 times as high as the rate for Caucasians in the year 2000, and twice as high as the rate for Hispanics.

Many have postulated that since the prevalence of HIV is different among African Americans than among Caucasian Americans, risk behaviors must be different, and prevention efforts must also be different. Unfortunately, little is known about the behaviors most associated with the transmission of HIV in African Americans. It is, however, known that since the AIDS epidemic began, 37% of AIDS cases among African American males were the result of homosexual contacts, 34% were due to injection drug use, and 8% were due to heterosexual contact. Among AIDS cases reported in African American women, 41% were among intravenous (IV) drug users, and 38% were attributed to heterosexual contact.

Prevention efforts for minority populations are further made complicated because the course of exposure is often unknown. While the leading exposure category among men of all other ethnic groups is homosexual contact, the leading exposure category among Black men is “unreported” or unknown risk.

Recently, many researchers, community and political activists, and patients have asked if the increased prevalence of HIV/AIDS in African Americans is a failure of African Americans to alter their behavior in a fashion to reduce risk or a failure of scientists to understand African American behaviors in a context that allows for the development of better prevention programs that ultimately reduce risk. While knowledge about AIDS has been attributed to decreased risk, racial minorities demonstrate less knowledge

about AIDS than do other populations. In its essence, a single system of prevention appears not to work for all communities. Many speculate that African American-specific programs may be needed to reduce the prevalence of this epidemic in African Americans. These programs may focus on presenting information in a context (maybe through churches and community organizations rather than from doctors, etc.) that African Americans trust, understand, and then can respond to, resulting in a change in risk behaviors.

The cognitive-behavioral model posits that thoughts precede emotions and behaviors. Consequently, thoughts and attitudes of African Americans become a target of scientific exploration when behavioral change and risk reduction for HIV/AIDS is desired. Since the vast majority of all HIV transmission is through sexual contact or shared illicit drug needles, prevention programs have depended, and maybe detrimentally so for African Americans, on social support factors and peer pressure as the basis of incidence reduction. However, the nature and importance of social support and peer pressure may vary across races/ethnicities and cultures, and consequently, the effectiveness of social and peer pressure techniques may also differ in effectiveness.

Few studies have explored the role of social support and peer pressure on health outcomes among African Americans, although there is evidence from other disciplines that social support is differentially experienced and valued as a function of race/ethnicity. For example, Killough, Webster, Brown, Houck, and Edwards (2003) recently found that the social factors that are most associated with academic success in young Caucasians (peer support, social support from friends, peer context, etc.) are, in fact, negatively related to academic success in African American youth. The family context, which is predictive of academic success in African Americans, is negatively associated with academic success in Caucasian youth. This study is suggestive that environmental factors may differentially exert influence on behavior as a function of race/ethnicity, and it provides a basis from which to explore such effects as they relate to health outcomes in African Americans and Caucasians.

Once an individual becomes infected with HIV, diagnostic process and treatment effectiveness may also vary by ethnicity. Treatment compliance with medical directives, which is often directly related to willingness to pursue treatment, is highly related to the conceptualization of "disease" within a race or

culture. For example, some view the contraction of HIV as a punishment for "sinful" or "inappropriate" behavior. An increasing number of individuals with this mindset are having unprotected sexual intercourse or may share infected needles as a mechanism to exert control over when and where they will be "punished" with this "inevitable" disease. Others view HIV transmission as a more random event, and only partly dependent on their behaviors. Yet others may attribute disease contraction and progression to their behaviors and their behaviors alone. It is obvious that such diverse conceptualizations of HIV transmission (cognitions), which often correlate with racial and cultural group membership, influence prevention behaviors, and consequently, risk of HIV/AIDS. Understanding the demographic and other characteristics of individuals who may be at highest risk for infection due to their cognitions and beliefs may be an effective tool for reducing the incidence of HIV.

The willingness to pursue medical treatment and to follow medical directives is often also dependent on the capacity to trust the professional providing medical care. Experiments such as the Tuskegee Syphilis Study, which was perpetrated by Caucasian physicians in a community medical setting on African American men, have set a tone for patient-doctor interactions that is often characterized by distrust and skepticism on the part of many African American patients. There is little evidence that this trend will change in the near future, as is shown by the tremendous difficulties associated with recruiting African Americans into clinical trials and clinical research studies. Knowledge of a history of overtly differential medical treatments for African Americans seen at major teaching hospitals prior to the 1980s and current disparities in health outcomes further fuel a sense of distrust for many. Specifically related to HIV and even more damaging to the treating professionals' rapport, many African Americans and other minorities believe that AIDS is a conspiracy perpetrated by the U.S. government in an effort to exterminate African Americans and homosexuals (Klonoff & Landrine, 1999).

These and other myths serve as the basis for many African Americans' interactions with medical professionals. More unfortunately, for those who suggest that African Americans and other minorities are overly and inappropriately paranoid and that they should just "get over" their fears, the reality of clinical atrocities and research misrepresentations and abuses against African

Americans at the local and national levels remain more horrific than the myths. For many African Americans, distrust, paranoia, and limited utilization of technological advances administered in major medical settings are reactionary and adaptive.

It is impossible to effectively treat African American patients today without consideration for the history, context, and role of African Americans in medical science. Certainly, whether clinicians consider such information or not, minority patients including African Americans do. When treatment is sought in such a poisonous environment, treatment compliance is often diminished by the above discussed beliefs and subsequent behaviors. The interpretation of limited compliance or noncompliance (missed appointments, noncompliance with medical directives, and overt mistrust of the medical profession), thus, among many African Americans must be done in the context of historical experiences and with sensitivity to the relationship between African Americans and the medical system.

Once infected with HIV, occurrence and severity of depression, anxiety, and somatization in HIV-infected persons vary as a function of ethnicity (Lichtenstein, Laska, & Clair, 2002; Heckman et al., 2000), as does subsequent responses to psychosocial treatments (Markowitz, Spielman, Sullivan, & Fishman, 2000). Coping styles are an important factor in the successful management of disease. African Americans and Caucasians differ in their disease-related coping styles; African Americans tend to have a larger percentage of family members in their support networks, and are less likely to tell friends of their HIV status, while the opposite is true for Caucasians. Older African Americans tend to rely more on passive coping (prayer, etc.), while Caucasians and younger patients tend to cope in a more active fashion (exercise, diet, etc.). There is evidence that both coping styles are productive in HIV disease management (prayer + exercise); however, exclusive use of either coping style is detrimental to health outcomes.

The disproportionate effect of HIV on African Americans clearly has little to do with race in terms of common biological or genetic descent and much to do with behaviors and sociocultural factors. Whether race and ethnicity are biological constructs is beyond the scope of this entry, but their social consequences are not. Race/ethnicity and the unique variance associated with being African American appear to influence disease outcomes detrimentally when comparing to Caucasians. But what about diseases

that predominantly affect African Americans? Are there examples of health behaviors worthy of highlighting without comparisons to Caucasians? We suggest that sickle cell disease is an excellent model of a condition that affects primarily African Americans and further illustrates health behaviors for the sake of better understanding African Americans.

## SICKLE CELL DISEASE

A major public health issue, sickle cell disease (SCD) affects 1 in 375 African Americans in the United States, and although less common, also affects people of Hispanic, Native American, East Indian, Greek, Italian, and Eastern Asian ancestry. SCD, like many other diseases with a substantial chronic pain component, has most recently been conceptualized as existing reciprocally as the product of biological, psychosocial, and behavioral factors. The acknowledgment of strong behavioral influences on the manifestation and management of SCD-related pain has led to the development and application of several behavioral models for treatment. Sociodemographic factors such as gender, age, education, and socioeconomic status as an index of attained wealth, as well as general psychological factors such as coping style, coping capacity, and social support, have been used to explain differences in disability associated with pain intensity, pain threshold, and pain tolerance, both clinically and in research settings.

Many of these sociodemographic and psychological factors have also been used to explain comorbid diseases and common reactions that often occur in response to unremitting pain including anxiety, anger, frustration, and depression. Of the potential reactions to unremitting pain, depression is the most often identified psychiatric condition among patients with SCD. Although it is not known whether depressive symptoms result from the psychosocial versus the somatic features of SCD, the functional consequences of depression and affective disturbance are negative and well known. It is estimated that as many as one fourth of patients with SCD experience depressive symptoms such as sadness, guilt, hopelessness, and helplessness. These emotional consequences can result in poor self-care, decreased quality of life, and increased disease impact.

Returning to the cognitive-behavioral model, patients with SCD who experience negative thinking about their capacity to manage their pain and disease tend to utilize the health care system more than patients with positive thinking patterns. In addition,

patients who report the most intense negative thinking patterns tend to experience the lowest tolerance for pain. Interestingly, these results have been found in children and adults. As they relates to SCD, psychosocial factors are intimately integrated in and appear to exert differential impact on the experience of pain, and pain on psychosocial functioning. Recognizing that thinking influences behavior, patients with the most negative thinking patterns have the potential for the most negative health care outcomes.

The complicated relationship between depression and SCD-related pain is possibly best illustrated by studies that evaluate the impact of treating depression in patients with chronic pain. Several studies demonstrate that the health condition of patients with SCD, including pain and disability, significantly improves when antidepressant and psychotherapeutic (cognitive-behavioral therapy) interventions were applied. These studies and many others suggest an intimate and reciprocal relationship between behavior, as the product of thinking and affect, and SCD management.

## THE FUTURE

Chronic psychological and social stressors produce biological, psychological, and social responses that are moderated by many factors including coping style and the availability of coping resources. Coping, which is a manifestation of thinking and an influence on emotional states, affects behavior. One coping strategy, John Henryism (JH), which is based on the story of the legendary John Henry, has most recently gained attention as a powerful stress coping strategy often adopted by many African Americans to manage stress associated with social inequities (James, Hartnett, & Kalsbeek, 1983). Even more recently, the relationship between JH and health outcomes has been explored as a possible explanation for disparities among African Americans and primarily Caucasian populations.

JH has traditionally been defined as a strong behavioral disposition to cope actively with stressors. Individuals who exhibit high JH tend to work harder and exert more effort in response to stress. Research has shown that JH has three basic components: (1) efficacious mental and physical vigor, (2) a strong commitment to hard work, and (3) a single-minded determination to succeed. In its simplest terms, JH is a behavioral manifestation of one's efficacy to meet environmental demands through hard work and determination.

Increasingly, JH is conceptualized as a more complex system of coping that includes psychological dispositions that are a function of experiences, beliefs and perceptions, patterns of responses to social contexts, and biological and genetic predispositions to actively cope with stressors. JH may actually be adaptive when sufficient financial, material, and interpersonal resources are available in a socially equitable environment. Thus, for individuals who have access to the appropriate environmental resources, JH, or a tendency toward hard work with a single-minded determination to succeed, may actually lead to positive health, employment, and social outcomes. However, in persons who have little formal education, limited financial and other resources, and consequently a higher susceptibility to the products of social inequity, high effort with a single-minded determination toward success may lead to frustration and disappointment, negative social consequences (failure, etc.), and chronic physiological arousal.

Empirical evidence has demonstrated that high levels of JH, when exhibited in the absence of financial and material resources, have been found to contribute significantly to the etiology of altered physical functioning and negative health outcomes such as elevated blood pressure and increased urine cortisol levels.

There appear to be tremendous opportunities to apply models such as JH to the exploration of health outcomes among African Americans in the future. For example, what is the impact of low and high levels of JH on prostate cancer outcomes in African Americans with and without adequate and available insurance coverage? Does coping, as conceptualized by the JH model, influence outcomes and management in chronic diseases where cure is not an option (chronic low back pain, osteoarthritis, etc.)?

In response to a changing zeitgeist, researchers and clinicians are beginning to reform the scientific literature to better integrate issues of diversity into the conceptualization of disease in African Americans. This evolutionary change promotes debate and guides the training of our clinicians of tomorrow toward the full integration of diversity into conceptualization and treatment of African American patients. This change also influences the clinicians of today to be more adequately responsive to the needs of a constantly changing U.S. demographic. Most notably, in diseases such as HIV/AIDS and SCD, understanding uniqueness associated with African Americans promotes a better understanding of the obstacles to "good" medical care. Furthermore, and particularly in diseases such as

SCD that predominantly affect African Americans, the integration of these factors results in a dramatic change in health outcomes. The challenge for the future appears to be the effective integration of models of diversity into medical care, which include an appreciation for differences in history and context. When applied to other diseases like prostate cancer, osteoarthritis, and Alzheimer's disease whose outcomes may also be influenced significantly by psychosocial factors, dramatic reduction of health disparities may be noted. A paradigmatic shift in scientific theory, training, and practice toward acknowledging shared experiences with an appreciation for uniqueness ensures our continued existence as providers of an effective health service to all populations.

—Christopher L. Edwards, Adrienne A. Williams, and Gary G. Bennett

See also ACCULTURATION AND HEALTH; ASIAN AMERICAN/PACIFIC ISLANDER HEALTH AND BEHAVIOR; HEALTH DISPARITIES; LATINO HEALTH AND BEHAVIOR

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## AGING AND HEALTH. See SUCCESSFUL AGING

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## AIDS AND HIV

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Approximately 21 years ago, HIV, the virus that causes AIDS, was first identified. Today, the World Health Organization estimates that there are 42 million people living with HIV/AIDS worldwide; 38.6 million of these are adults, 19.2 million are women, and 3.2 million are children under the age of 15. In 2002 alone, 5 million new HIV infections occurred, and 3.1 million people died of HIV/AIDS-related causes. HIV/AIDS is now the leading killer among all infectious diseases, and is ranked fourth among all microbial causes of death. From its identification to the end of year 2002, about 27 million people died from AIDS. It is now the seventh leading cause of death among 1- to 4-year-olds, sixth among 15- to 24-year-olds, and second among 25- to 44-year-olds



in the United States. About 95% of HIV infections are concentrated in developing countries. The first reported cases of AIDS in the United States were identified in 1981.

HIV causes AIDS. Over time, HIV depletes the subset of lymphocytes called T4 helper cells, or CD4+ cells, that are essential in the proliferation of cells necessary for cell-mediated immunity and the production of antibodies that protect us from infections. Without the ability for the body to produce these cells, we are vulnerable to a variety of infections caused by organisms and viruses that normally do not cause disease in individuals. It is these infections that create the symptoms and progression of illnesses that eventually kill patients who have AIDS. The Centers for Disease Control and Prevention (CDC) defines AIDS broadly as the onset of life-threatening illness that occurs as a result of HIV disease that originates with the infection of a person with HIV. Early in the epidemic, AIDS was thought of as the end stage of the disease process. However, since persons who receive an AIDS diagnosis who receive specialized treatments may recover from these AIDS-defining illnesses, receiving the diagnosis of AIDS is no longer necessarily associated with imminent death.

#### WHAT ARE THE STAGES OF HIV?

A person with normal T4 lymphocyte counts typically has approximately 1,000 cells per deciliter of blood volume. A person acutely infected with HIV commonly drops to a level of approximately 500 cells per deciliter. The CDC defines AIDS as all HIV-infected persons who have less than 200 T4 lymphocytes per deciliter of blood, or T4 lymphocytes percentage less than 14% of total lymphocytes. In addition, there are 23 clinical conditions that define AIDS including diseases such as pulmonary tuberculosis, recurrent pneumonia, and Kaposi's sarcoma.

#### HOW IS HIV TRANSMITTED?

There are three basic mechanisms through which HIV is transmitted: unprotected sexual contact, needles and syringes, and mother to child. All of these mechanisms involve an exchange of body fluids. The body fluids involved in HIV transmission are exchanged during sexual activities, injection drug use, blood transfusions, use of blood products, and during pre- and postnatal events. HIV enters the body

through the lining of the vagina, vulva, penis, rectum, or mouth during sex. Worldwide, the highest frequency of HIV transmission is among heterosexuals. In the United States, males make up 80% of all AIDS cases. The majority of these cases are among men who have sex with men (42%), followed by injection drug use (35%), men who have sex with men and inject drugs (10%), hemophilia/coagulation disorders (1%), and heterosexual contact with injecting drug users, sex with persons with hemophilia, sex with a transfusion recipient with HIV infection, or sex with an HIV-infected person with a risk that it is not specified (4%). An additional 1% of individuals have been infected through receiving a blood transfusion or blood components or through tissue transplant. A final 7% of individuals have an undetermined mode of infection.

Females make up approximately 20% of the AIDS cases in the United States. Of these cases, 46% were infected through drug use. Approximately 49% were infected through heterosexual contact with an injecting drug user, a bisexual male, a person with hemophilia or transfusion recipient with HIV infection, or an HIV-infected person whose risk was not specified; 3% of women were infected through blood transfusion, blood components, or tissue transplants; and approximately 2% were undetermined.

A total of 645,600 males had been diagnosed with AIDS as of 2001, with an additional 161,400 women in the United States. However, it is unknown how many individuals are infected with HIV but do not have AIDS. Among those who have AIDS, the CDC reports that 473,280 people were infected through unprotected sex, 204,000 were infected who shared needles, 53,000 were infected who had both unprotected sex and shared needles, 57,120 did not know how they were infected or did not report their risk or died before anybody could find out, 17,544 people got HIV from infected blood or blood products, 11,016 children were infected through their mothers, and 80 health care workers got infected through the blood or body fluids of patients.

#### HOW DO WE TREAT HIV INFECTION?

There is currently no cure for HIV disease. From March 1987 through early 2002, 16 anti-HIV drugs had received Food and Drug Administration approval, and two others had received expanded access approval. Unfortunately, these drugs are not curative,

and each has side effects. The most effective therapies are made up of combinations of drugs, often called triple drug therapy, or highly active antiretroviral treatment (HAART). Medications used to treat HIV are expensive, making them inaccessible to the large numbers of individuals infected with HIV in third world countries. The treatments require taking many pills across the course of each day.

Following HIV infection, there is a depletion of immune cells called CD4, or T4 cells. As the number of these cells is reduced, the immune system is unable to respond to various opportunistic infections. Individuals are then susceptible to protozoa (e.g., *Toxoplasma gondii*), which can lead to gastroenteritis or encephalitis; fungi (e.g., *Pneumocystis carinii*), which can lead to pneumonia or meningitis; bacteria (e.g., *Mycobacterium*), which cause tuberculosis; viruses (e.g., *Cytomegalovirus*), which cause hepatitis, fever, encephalitis, retinitis, pneumonia, colitis, and esophagitis; and cancers such as Kaposi's sarcoma.

Each of these diseases requires different treatments. For medical practitioners, this complexity of treatment means that many patients have problems with adherence to recommended treatments. Lack of adherence can lead to the patient developing drug-resistant strains of HIV. In addition to treatment complexity, lack of adherence can result from a number of sources including the potential for the development of cognitive problems. These problems arise from various infections of the central nervous system that may lead to memory problems, or in the worst-case full-blown dementia. In addition, HIV/AIDS is a stigmatizing illness and infected individuals may avoid disclosing their serostatus to family, friends, and coworkers. To avoid detection by others, doses may be missed. Finally, years of treatment sometimes result in infected persons tiring of the treatments and their associated side effects. This leads some patients to take "drug holidays," which may lead to drug resistance.

## HOW DO WE PREVENT THE SPREAD OF HIV?

To date there is no effective vaccine that prevents the acquisition of HIV. Aside from protection of our blood supply, all prevention takes the form of behavioral prevention. The majority of interventions have been focused on HIV-negative individuals who are at high risk of becoming infected (e.g., intravenous drug users, men who have sex with men). Needle exchange

programs have been shown to dramatically reduce the number of new infections among this segment of the population.

While there are many studies under way, efforts to change sexual behaviors have been less successful. Change in behavior is sometimes seen, but relapse to high-risk behavior is common. A smaller number of studies have focused on HIV-positive individuals who have unprotected sex with HIV-negative or unknown-status partners. It has been estimated that approximately 33% of HIV-positive individuals continue to have unprotected intercourse. The advantage of focusing on this group is that this represents a small number of individuals relative to the population as a whole, and such efforts should therefore be more cost-effective. Though small in number, results from interventions directed at this population have been promising. The issue of whether to target the general population versus specific groups is controversial, and while the distinction appears to be clear at first glance, the distinction is somewhat artificial. For example, sex with drug users may be a bridge between HIV-negative and -positive groups. In addition, it should be noted that sex between two HIV-positive individuals is also risky since infection with other sexually transmitted diseases (STDs) can have negative health consequences for an already immunocompromised individual. It should be noted that the CDC provides a Web site that promotes evidence-based interventions and provides materials for prevention efforts.

## WHERE DO WE CONDUCT PREVENTION EFFORTS?

In part the answer to this question depends on the population one wishes to target. HIV-infected individuals may be best reached in medical clinics where they seek care. STD clinics see groups of individuals who are by definition at high risk. In fact, having an STD increases the chances of becoming infected when exposed to the virus. To date little work has been conducted in these settings. Needle exchange programs have been conducted primarily in street outreach settings. However, there is increased interest in using pharmacies. However, this is not always practical since there are uneven laws, which are sometimes conflicting within a single jurisdiction. Conducting interventions in community-based organizations has the advantage of catering to specific populations in the neighborhoods where the population exists.

A number of areas of technology provide promise in HIV prevention efforts. For example, the World Wide Web can reach large numbers of individuals at a low cost and reaches individuals who might not otherwise be willing to participate in prevention programs. For example, men who have sex with men and live in rural communities are often unwilling to participate in such interventions. The Web provides an opportunity for this group to participate in an anonymous manner. Unfortunately, there are few published reports on the effectiveness of such interventions.

Adherence is another area in which technology may be helpful. Adherence may be improved through the use of watch timers, or automated computer programs that call patients with customized reminders to take their medications. Drug companies have taken advantage of these technologies in some areas to increase market share of costly drugs by providing these services at no cost to the patient.

Finally, technology may assist in assessments of risk behavior. Drug and sexual behaviors are private behaviors that may be illegal. Some data suggest that computerized questionnaires increase the accuracy of self-report. This may be due to decreased demand characteristics that individuals may feel when questioned by a human. For example, knowing he or she is participating in a sexual risk reduction intervention may lead a participant to minimize the number of high-risk encounters he or she has in some period. It should be noted that underreporting is but one problem of self-report. Problems also include overreporting, or in cases of high frequency of behaviors (e.g., number of sex partners for sex workers, or frequency of drug use) inaccurate reports may happen.

## WHAT ARE THE PSYCHOLOGICAL RESPONSES TO HIV INFECTION?

Psychological conditions associated with HIV illness can be categorized into adjustment disorders, anxiety and mood disorders, psychosis, and substance use disorders. In the context of HIV, the rates of adjustment disorders with depressed, anxious, or mixed features differ according to the population studied and appear to vary across key transition points. As might be expected, rates are highest in the days and weeks after an individual tests seropositive and may be elevated especially in workplace settings where testing is mandatory (e.g., military populations). In contrast, among individuals who have been voluntarily tested

and have known their serostatus on average for at least 1 year, rates of adjustment disorder are much lower even though these persons may be dealing with other HIV disease progression or treatment concerns. Crisis management has been shown to be effective in reducing the risks of adjustment disorder.

The rates of the major anxiety disorders in HIV—panic disorder, obsessive-compulsive disorder, and generalized anxiety disorder—appear to have lifetime and current prevalence within the range expected from community epidemiological studies and appear to be similar in prevalence across all disease stages. Their course is generally favorable and similar to that expected in non-HIV samples.

Individuals at risk for HIV infection appear to have elevated rates of major depression that preceded infection; after infection, their risk of major depression is at least in line with rates in populations of other chronic medical and neurological illness (e.g., stroke, multiple sclerosis, Alzheimer's disease, Huntington's disease, Parkinson's disease). Patients with primary bipolar disorder (manic-depressive) are believed to be at increased risk for HIV infection due to sexual sprees, poor judgment, and the disinhibiting effects of concurrent alcohol or drug use.

Prevalence estimates of psychotic disorders in HIV vary widely depending on study methodology. If one considers the prevalence of HIV infection for patients with schizophrenia being admitted to psychiatric hospitals in urban epicenters of the AIDS epidemic, perhaps 10% of schizophrenic persons are infected. When the psychotic disorder is due to HIV, large-scale surveys find low prevalence (< 0.5%).

Substance use disorders are important to detect for a number of reasons. For example, abuse or dependence can heighten likelihood of transmitting HIV by sharing of infected "works" by intravenous drug users (IDUs). In addition, non-IDU drug or alcohol abuse has been associated with higher-risk sexual behaviors. Finally, intoxication or withdrawal symptoms can complicate the neuropsychiatric presentation of the HIV-infected patient and complicate the identification and treatment of mood or psychotic disorders. Although some studies show higher current rates of substance use disorders among seropositive gay and bisexual individuals compared with those expected from community samples, others show roughly comparable or only slightly higher rates.

Another psychological topic that is important in HIV is suicide; there may be a 30-fold risk of committing

suicide among those with advanced disease compared with those who are seronegative matched for age and social position. Fatigue is also common in individuals with advanced disease. Decreased sleep quality, difficulty falling asleep, nighttime fragmented sleep, and early-morning awakenings seem to increase as immune function is compromised. Finally, pain has increasingly been recognized as a problem in HIV patients.

Almost any area of behavioral science has contributed to the body of literature on HIV. Not covered in this section were stress, social support, coping, and other closely allied areas of research. Nor did we review the compendium of work on psychoneuroimmunology as it relates to HIV progression. As this entry is being written, the number of new HIV infections continues to climb unabated. It is clear that the proximate cause of HIV infections resides in human behavior, most of it ordinary, some linked to psychopathology, but all of it potentially modifiable. The challenge to scientists and clinicians working in this area is to find efficacious ways to modify these behaviors in a cost-effective manner.

—Thomas L. Patterson

NOTE: This work was supported by NIDA, NIMH, and the VA.

*See also* AIDS AND HIV: ADHERENCE TO MEDICATIONS IN PERSONS WITH HIV INFECTION; AIDS AND HIV: PREVENTION OF HIV INFECTION; AIDS AND HIV: STRESS

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## AIDS AND HIV: ADHERENCE TO MEDICATIONS IN PERSONS WITH HIV INFECTION

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### IMPORTANCE OF ADHERENCE TO ANTIRETROVIRAL THERAPY

Antiretroviral therapy is dramatically changing the course of HIV infection by influencing the medical management and health outcomes of persons with HIV infection (PWHIV). While this therapy has brought an increased sense of optimism and hope for PWHIV, it requires patients to be highly committed and strictly adhere to the therapeutic regimen. Adherence rates as high as 95% may be necessary (Paterson et al., 2000). In addition, there is a need for close monitoring of viral

load (HIV RNA) and CD4 T-cell counts to assess the effectiveness of the therapy (Andrews & Friedland, 2000). Investigators have demonstrated that lapses in antiretroviral adherence (missed doses) lower the likelihood of suppressing viremia below detectable levels (Paterson et al., 2000).

HIV is a retrovirus characterized by the presence of an enzyme, viral reverse transcriptase. This enzyme gives retroviruses the unique ability to synthesize DNA using an RNA template. The viral DNA is subsequently incorporated into the genome of the CD4 T-cell, the principal target for HIV, and replicates (Geleziunas & Greene, 1999). In the 1980s, researchers believed that HIV was a relatively silent virus and that HIV infection progressed slowly. Recent research demonstrates that HIV infection is a dynamic state in which billions of virions are produced and destroyed daily (Geleziunas & Greene, 1999).

Reverse transcriptase, the enzyme that copies the HIV genome, is error-prone, and makes, on average, one transcription error each time viral RNA is transcribed (Geleziunas & Greene, 1999). Consequently, the potential for viral mutation is high in PWHIV. Viral mutations along with subtherapeutic antiretroviral levels may result in the development of drug-resistant viruses and a worsening of symptoms (Geleziunas & Greene, 1999). In addition, adherence to antiretroviral therapy is associated with an increase in HIV RNA and the emergence of viral resistance.

### FACTORS ASSOCIATED WITH ADHERENCE TO ANTIRETROVIRAL THERAPY

Health care professionals and researchers are only beginning to understand the dynamic and complex nature of adherence to antiretroviral therapy. This understanding is necessary in order to match patient readiness with interventions designed to help patients adhere to the prescribed regimen. Studies published in the mid-1990s documented variable rates of adherence to antiretroviral drugs in PWHIV, ranging anywhere from 30% to greater than 90%. More recent studies continue to show a wide range (60-95%) of self-reported adherence. Researchers have demonstrated that PWHIV discontinue the use of antiretroviral medications on their own and report intentional missed doses and "drug holidays."

Identifying and understanding the factors that contribute to nonadherence is necessary in order to develop effective interventions that improve adherence

to antiretroviral therapy in PWHIV (Andrews & Friedland, 2000). Many of these factors occur simultaneously. Factors such as regimen complexity, number of prescribed drugs, dosing schedule, and side effects increase the likelihood of nonadherence to antiretroviral therapy. Other factors related to nonadherence include beliefs that treatment prolongs life, mood changes and greater depression, the need for psychiatric consultation, forgetting or taking less medication than prescribed, and substance abuse (Chesney, Morin, & Sherr, 2000; Paterson et al., 2000). Qualitative researchers have also examined the experience of medication taking among PWHIV. This work shows how side effects, dosing schedule, meal planning, and being away from home at the time a medication was to be taken contributed to nonadherence (Erlen & Mellors, 1999).

Race, symptoms, and stress have been shown to be associated with poorer adherence in PWHIV, whereas increased access and social support have been found to be associated with greater adherence. Other researchers have demonstrated that nonadherence is related to living a "marginal" lifestyle, one's social situation, and barriers such as being reminded of being HIV positive, not wanting others to know, and forgetting to ask providers questions (Catz, Kelly, Bogurt, Benotsch, & McAuliffe, 2000).

We are finding in our own work that perceived self-efficacy is significantly positively associated with adherence measured using both electronic event monitors and self-report. Also, physiological variables (symptoms, substance abuse, and perceived burden of regimen) and psychological variables (depression, social support, personality characteristics, and perceived stigma) are showing significant relationships with self-efficacy suggesting that self-efficacy may mediate these factors and adherence.

## INTERVENTION STUDIES TO IMPROVE ADHERENCE

Many people with chronic illnesses have difficulty following self-administered medication regimens, yet there are limited studies of interventions to improve adherence. One review article of adherence-promoting interventions tested in randomized controlled trials (RCTs) reported only 13 studies that used randomization, a control group, measure(s) of adherence, measure(s) of outcomes, and follow-up (Haynes, McKibbin, & Kanani, 1996). None of the

13 studies focused on PWHIV. The studies used various cognitive-behavioral interventions; half reported statistically significant improvement in adherence or treatment outcome among patients. Several studies had small samples, insufficient power to detect clinically meaningful effects, and short follow-up periods. More recently, McDonald, Garg, and Haynes (2002) reviewed adherence intervention RCTs (1967-2001). Of the 33 RCTs meeting inclusion criteria, only two studies had samples of PWHIV. Half of the 33 studies reported significant outcomes.

Psychoeducational interventions are demonstrating that they can help PWHIV achieve a self-reported adherence rate of 95% or higher. We are studying the effect of a multicomponent structured telephone-delivered intervention grounded in cognitive-behavioral therapy and targeted at various factors associated with adherence in PWHIV. This intervention is beginning to show a greater increase in adherence in the intervention group compared to the usual-care group. While treatment subjects become more adherent than control subjects, their adherence is not perfect.

Interventions that are used to improve adherence may need to be individualized because the person's needs change as his or her perspective about the disease or treatment changes. Published reports do not support one strategy consistently. Thus, multiple strategies from which providers can choose may be necessary to improve adherence. In addition, there is a need to consider the patient as partner and an active participant in the intervention. This approach is consistent with the literature that supports respect for patient autonomy as a key ethical value in understanding adherence. An individualized intervention has the potential to involve and support the patient throughout the intervention and address the multidimensional aspects of nonadherence: provider/health system-related, condition-related, therapy-related, and patient-related factors (Bartlett, 2002).

## HEALTH OUTCOMES

Given current knowledge, PWHIV will need to self-manage daily medication taking for the rest of their lives. Therefore, the patient's clinical response and quality of life are relevant health outcomes when assessing or intervening to improve adherence to antiretroviral therapy. Clinical response can be assessed through objective measures of viral load, CD4 T-cell counts, hospitalizations and emergency room visits

related to HIV infection, and increases in illness-related symptoms. On the other hand, quality of life is a subjective judgment on the part of the patient that can change over time. Improved therapies and increased length of survival have heightened the interest in examining quality of life in PWHIV.

Using assessments of viral load and CD4 T-cell counts, researchers are showing that low adherence and decreased therapeutic efficacy are related. When there are decreases in viral load, increases in CD4 T-cell counts, decreases in number of hospitalizations, and decreases in AIDS symptoms, health professionals can presume treatment efficacy due to patient adherence with treatment (Paterson et al., 2000).

Assessing quality of life provides a measure of how the lives of PWHIV are affected by adherence to antiretroviral therapy. As longevity increases, the satisfaction that PWHIV perceive from those aspects of life deemed to be of personal importance becomes even more significant. Some evidence exists that there is increased quality of life when patients adhere to their medication regimen (Erlen & Mellors, 1999). Because all aspects of quality of life are affected in PWHIV who are managing their adherence to a complex medication regimen, enabling PWHIV to adapt their lifestyle to a life that includes antiretroviral therapy and to adopt new health behaviors like adherence is very important.

#### IMPLICATIONS FOR RESEARCH AND CLINICAL PRACTICE

Antiretroviral drugs can be very effective therapy; however, the medications can be efficacious only if they are taken correctly. The regimen complexity and the various side effects increase the likelihood for PWHIV to be nonadherent. The documented evidence of nonadherence in PWHIV supports the need for well-designed intervention studies to promote and assess adherence to prescribed antiretroviral therapy.

Behavioral research is needed to address issues related to living with HIV. Since PWHIV will have to take these medications for the remainder of their lives, promoting adherence will require an intervention and maintenance program and periodic boosters to achieve positive health outcomes. Randomized clinical trials are needed to examine outcomes of behavior and the influence of self-efficacy on that behavior. Research needs to target the treatment of HIV infection and the management of adherence to long-term treatments.

From a clinical perspective, interventions need to use a multidisciplinary approach and be tailored to the patient's situation (Bartlett, 2002). Developing habits or using devices to remember to take medications, using support systems, and keeping medication diaries are strategies that can be incorporated into the patient's adherence plan. Comorbid conditions such as depression and substance abuse need to be addressed (Bartlett, 2002). While patient-related factors need to be considered, health professionals also need to attend to regimen-related, provider-related, and system-related factors that have the potential to affect adherence. The goals from both a research and a clinical practice perspective are to improve clinical outcomes and quality of life among PWHIV and to ultimately decrease health care costs.

—Judith A. Erlen, Mary Pat Mellors,  
and E. Sue Lehman-Trzynka

See also AIDS AND HIV; AIDS AND HIV: PREVENTION OF HIV INFECTION; AIDS AND HIV: STRESS

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## AIDS AND HIV: PREVENTION OF HIV INFECTION

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Infection with HIV is the cause of AIDS. A person becomes infected with HIV when HIV-contaminated blood, semen, vaginal secretions, or breast milk enters his or her bloodstream. HIV transmission has occurred during blood transfusions, occupational and accidental exposure, maternal-child transmission, sharing of drug injection syringes or needles, and unprotected sexual intercourse. Although it is not possible to cure a person with AIDS, it is possible to prevent, or at least to reduce the likelihood of, HIV transmission through each of these routes.

### PROTECTING THE BLOOD SUPPLY

Early in the epidemic, before the virus was identified and procedures to test the blood supply were available, some people were infected by contaminated blood or blood products. Persons requiring frequent blood transfusions, such as those undergoing surgery or being treated for hemophilia, were most vulnerable to this mode of HIV transmission.

In 1985, it became possible to test blood for antibodies (molecules in the blood that are released to neutralize or destroy bacteria, viruses, or other microorganisms that invade the body) to HIV. Known as ELISA, or the enzyme-linked immunosorbent assay, this test identifies blood that may be infected with HIV.

Since 1985, efforts to prevent transmission of HIV through blood transfusions have relied on three strategies. First, all donated blood is now tested for HIV antibodies (as well as for hepatitis and syphilis). Second, potential blood donors with high-risk histories are not allowed to donate blood. Third, blood products that are infected with HIV are discarded.

Although there remains a very minute risk of receiving HIV-infected blood in a transfusion (the

antibody test used to detect HIV is not 100% perfect and blood donors who have been infected with HIV very recently may not develop antibodies for a few weeks), the likelihood of such transmission in the United States and most developed countries is now extremely low. Nucleic acid testing, a procedure that screens blood for HIV directly, promises to increase the safety of the blood supply even further in the coming years.

The blood supply outside of the United States and other developed countries remains a source of concern. Many developing countries cannot afford to screen their blood products and transmission via this mechanism continues.

### MINIMIZING OCCUPATIONAL AND ACCIDENTAL EXPOSURES TO HIV

Occupational exposures to contaminated blood and accidental needle-sticks among health care workers have led to some documented cases of HIV in the United States. The number of actual infections caused by this route is relatively small, but such infections have been reduced further in the United States through several prevention strategies.

One strategy involves the adoption of "universal precautions" procedures. Universal precautions begin with the assumption that all patients in health care settings could be infected with HIV; therefore, emergency medical personnel, health care workers, and others likely to come into contact with bodily fluids automatically protect themselves by wearing latex gloves and other protective coverings when caring for their patients. In addition, health care workers are required to dispose of uncapped needles and syringes in specially made, puncture-resistant containers. Universal precautions procedures also involve the incineration (or careful discarding in heavy-duty plastic bags) of medical waste, trash, and linens in hospitals and other health care settings.

Universal precautions procedures have also been used at athletic events to prevent accidental exposure to HIV from athletes who sustain a skin abrasion during a sporting event. Although the odds of HIV being transmitted from one athlete to another are believed to be exceedingly low (less than 1 in 1 million), at most sporting events athletes who sustain even a minor skin abrasion must leave the competition temporarily (to have the abrasion bandaged) so that no blood is accidentally transferred to other players.

A second strategy to reduce occupational or accidental transmission involves the use of postexposure prophylaxis, or PEP. This strategy, which typically involves completing a 1-month regimen of antiretroviral medications similar to those used to treat HIV infection, is used only when a person is exposed to a bodily fluid. In the case where an uninfected person is accidentally exposed to HIV, the use of PEP reduces the odds of HIV infection occurring by as much as 81%. Therefore, the Centers for Disease Control and Prevention now recommends PEP for health care workers who are accidentally exposed to HIV-infected body fluids.

As with blood screening, limited resources for medical supplies in many poorer countries make it difficult for these countries to implement such strategies to reduce accidental and occupational exposures.

## REDUCING MATERNAL-CHILD TRANSMISSION

Transmission of HIV from a mother to her infant child can occur through the placenta before birth and during delivery. The likelihood of perinatal transmission without medical intervention is estimated to be 25%. The risks of such transmission can be reduced to less than 10%, however, if a pregnant woman takes zidovudine (AZT) during pregnancy followed by brief treatment of the newborn infant. Such prevention strategies are used routinely now in the United States, and efforts are under way to make such treatments available worldwide; sadly, however, many women in developing countries still do not have access to such treatments.

Maternal-child transmission can also occur through breast-feeding after birth. Therefore, in the United States and other developed countries, HIV-infected mothers are discouraged from breast-feeding and advised to use commercially prepared infant formula instead. However, in countries where clean water is not available, and where infectious diseases and malnutrition cause significant infant mortality, the World Health Organization and other organizations recommend breast-feeding despite the possibility of HIV infection.

## PREVENTING HIV TRANSMISSION AMONG PEOPLE WHO USE INTRAVENOUS DRUGS

People who use intravenous drugs (e.g., heroin) can inadvertently transmit HIV to an uninfected person if they share their drug injection equipment or

“works” with one another. This is because needles and syringes often have small residual amounts of HIV-infected blood that can mix with the next users’ blood and lead to infection. If infected blood is present in a syringe that is shared, the likelihood of transmission is high. Indeed, in the United States, sharing of unsterilized drug injection syringes or needles accounted for 27% of the new infections in 2001.

Two prevention strategies have been used to help reduce the likelihood of HIV transmission among persons who use injection drugs. The first, a harm reduction approach, involves discouraging needle sharing through educational strategies and making clean needles available through needle exchange programs. Two studies completed in the United States found that HIV incidence was reduced by needle exchange programs; other studies in Canada and the Netherlands reported that needle exchange had no effect on HIV incidence (Carey & Venable, 2003). Despite this mixed evidence, most public health experts believe that needle exchange programs reduce needle sharing and may reduce HIV incidence; moreover, such programs also serve as an important link to drug treatment and other clinical services that can further reduce HIV risk.

A second strategy for risk reduction among people who inject drugs is to provide treatment for the drug abuse problem. Drug abuse treatment can reduce HIV risk both directly and indirectly. Direct effects can result from intervention components that target both risky sexual behavior and needle sharing. Indirect benefits result from improved decision making regarding partner selection and risk practices.

## REDUCING THE RISK OF SEXUAL TRANSMISSION OF HIV

In the United States and throughout the world, the most common method of HIV transmission involves unprotected vaginal or anal intercourse. Recent data from the United States indicate that 71% of the new infections in 2001 were the result of unprotected sexual intercourse. Epidemiological evidence suggests that transmission occurs most frequently through unprotected anal or vaginal intercourse but that transmission may also occur as a result of oral intercourse.

### Abstinence Programs

The most effective way to eliminate the sexual transmission of HIV would be to abstain from all



penetrative sexual activities. This prevention strategy has been recommended for adolescents who have not yet become sexually active or who are thought to be too young for sexually intimate relationships. A recent study by John Jemmott and his colleagues (Jemmott, Jemmott, & Fong, 1998) has provided evidence regarding the efficacy of an abstinence program. These authors evaluated the effects of an abstinence-oriented HIV prevention program by comparing it to a safer-sex program and a health promotion control group. The abstinence intervention stressed delaying intercourse, whereas the safer-sex intervention encouraged condom use if teens were sexually active. Both interventions took place during eight 1-hour meetings led by trained facilitators. The participants were 659 African American adolescents who were recruited from middle schools in low-income inner-city communities.

The efficacy of the interventions was determined by asking participants to complete confidential surveys regarding their sexual behavior 3, 6, and 12 months following the intervention. Self-report surveys were designed and administered carefully to optimize the participants' ability to recall their behavior and their willingness to disclose such sensitive material. Such self-reports, when carefully administered, provide data that are believed to be both reliable and valid (Weinhardt, Forsyth, Carey, Jaworski, & Durant, 1998).

The results the Jemmott et al. (1998) study indicated that, at the 3-month follow-up, adolescents in the abstinence intervention were less likely to report having sexual intercourse than were control group participants; however, this effect weakened at the subsequent follow-up evaluations. As expected, students in the safer-sex intervention reported higher frequency of condom use at all follow-ups. Among adolescents who reported sexual experience at baseline, the safer-sex intervention group reported less sexual intercourse at 6- and 12-month follow-ups than did the control and abstinence intervention, and less unprotected intercourse at all follow-ups than did the control group. The results indicate that both abstinence and safer-sex interventions reduced HIV sexual risk behaviors but that safer-sex interventions have longer-lasting effects and are more effective with sexually experienced adolescents.

### **Sexual Risk Reduction Programs**

For adults and adolescents who remain sexually active, prevention efforts tend to encourage one or

more risk reduction strategies. One strategy involves mutual monogamy with an uninfected partner. This approach prevents HIV only if two partners (a) get tested for HIV prior to having sexual contact, (b) test negative, and (c) agree to have no other sexual partners. If such conditions are met, then HIV infection as a result of unprotected sex within the relationship is very unlikely. (There remains a very small chance that the HIV test was inaccurate or that the results did not reflect a very recent infection with HIV because HIV antibodies may not develop for a few weeks after infection.)

A second strategy involves "negotiated safety." In such a relationship, partners typically agree to steps (a) and (b) but not (c) above. Instead, they agree to use a condom if they have sexual relationships outside of their primary relationship.

A third strategy involves reducing the number of sexual partners, or shifting from higher-risk to lower-risk sexual activities (e.g., from vaginal sex to oral sex). These strategies reduce risk somewhat but still leave a person quite vulnerable to infection should they have a sexual relationship with an infected partner.

A fourth risk reduction strategy involves condom use. If used consistently and correctly with all partners, latex condoms significantly reduce the risk of HIV transmission.

Collectively, these risk reduction strategies are sometimes referred to as "safer sex," a term that is intended to convey the idea that any sexual contact involves some risk, and none of these strategies reduces risk completely. However, such practices do reduce the risk considerably and are "safer" than high-risk practices involving unprotected sex with multiple partners whose HIV status is unknown. Overall, the level of protection provided by these strategies depends on the circumstances, partner characteristics, and actual behaviors.

There is now a large literature devoted to evaluating the efficacy of such safer-sex strategies. Risk reduction programs have been evaluated in a wide range of settings, including clinics that provide services for sexually transmitted diseases (STDs), family planning, and other sexual health needs; primary, secondary, and higher educational environments; prisons; military bases; and a range of community-based settings. Programs have been tailored to address the unique needs of men who have sex with men, heterosexual women, adolescents, alcohol and drug users, persons living with mental illness, and other populations.

Although most research has been conducted in the United States, there is now a substantial amount of research that has been conducted throughout the world.

Two large studies in the United States demonstrate that well-designed intervention programs can lead to reduced risk behavior and lowered incidence of new STDs. The National Institute of Mental Health (1998) Multisite Study investigated the efficacy of a group-based intervention with 3,706 high-risk men and women who were recruited from 37 medical clinics across the United States. The intervention evaluated was based on Jeffrey Kelly's (1995) skills training approach and was administered to small groups during seven sessions. Participants who learned self-management and condom use skills, as well as interpersonal skills and education about HIV, reported fewer unprotected sexual acts, had higher levels of condom use, and were more likely to use condoms consistently over a 12-month follow-up period. In addition, those men who were recruited from an STD clinic also had a gonorrhea incidence rate that was one half that of the control group.

A second study, sponsored by the Centers for Disease Control and Prevention, investigated an individualized intervention and was conducted in publicly funded STD clinics (Kamb et al., 1998). This trial enrolled men and women once they agreed to have an HIV test, and tested two interventions (a four-session counseling program lasting 200 minutes, and a two-session counseling program lasting 40 minutes), and compared them both to a standard care (educational) program. Compared with participants in the educational program, participants in both counseling interventions reported more condom use at 3 and 6 months postintervention. After 6 months, 30% fewer participants in both counseling interventions had new STDs, and after 12 months, 20% fewer participants had new STDs. Benefits were similar for men and women.

Scholarly reviews of many studies consistently identify several characteristics of effective HIV prevention programs to reduce the risk of sexual transmission. First, such programs have been developed from theoretical models that identify multiple determinants of sexual risk behavior. The most prominent models are derived from Albert Bandura's (1994) social-cognitive theory, and recognize the influence of intrapersonal, interpersonal, dyadic, and other environmental factors. Second, successful interventions often have a strong behavioral skills component, which helps

program recipients to strengthen self-management, condom use, and interpersonal negotiation skills while simultaneously becoming better informed about HIV transmission and prevention, and more aware of personal vulnerability to HIV infection. Conversely, it is recognized that prevention programs that only provide HIV education tend to be a much less effective method for reducing risk behavior (Johnson, Carey, Marsh, Levin, & Scott-Sheldon, 2003).

Evaluation of existing prevention programs for reduction of sexual transmission has also identified some limitations. One concern involves the dissemination of empirically demonstrated interventions to large populations and to community-based providers. An innovative approach to dissemination based on social diffusion theory involves recruiting and training "popular opinion leaders" who then attempt to influence friends and associates in their social networks. This approach has shown initial promise and may be an efficient method of disseminating risk reduction strategies across a large population.

A second concern involves the durability or sustainability of risk reduction. Most research studies follow participants for 1 year or less, and often reveal that the prevention effects tend to decrease over time. Because the need for behavior change is lifelong, such findings suggest the need to develop more effective methods to extend the benefits of risk reduction programs. The use of media messages to provide support and encouragement for people who have reduced their risk is one approach being investigated by public health researchers.

#### *Risk Reduction for HIV-Infected Persons*

Most primary prevention programs target people who are at risk for, but not yet infected with, HIV. An alternative and potentially more efficient approach to preventing new infections is to implement behavior change interventions for people who are already infected with HIV. Although many persons living with HIV refrain from risky sexual behaviors, studies of gay men, injection drug users, and patients recruited through HIV clinics indicate that at least 30% of persons living with HIV engage in risky sexual behaviors.

Sexual risk behavior among persons living with HIV is important for at least three reasons. First, such behavior threatens the health of people who are not yet infected. Second, HIV-infected patients who engage in risky sexual behavior, especially those who

develop multiple drug resistances to HIV combination therapies, may then transmit drug-resistant HIV strains to HIV-positive sexual partners; such “reinfection” or “superinfection” with a treatment-resistant strain of HIV is believed to contribute to poor treatment outcomes. Third, HIV-positive individuals who engage in unprotected sex may become infected with other STDs. The presence of other STDs increases HIV infectivity, making it more likely that HIV will be transmitted to uninfected partners.

Paradoxically, the availability of improved HIV treatments has eroded commitment to safer sex due to the belief that AIDS is no longer the dire health threat it had been. Such concerns may be particularly relevant to persons living with HIV because they have had more direct experience with the newer therapies. In a study involving HIV-positive and HIV-negative gay men (Venable, Ostrow, McKirnan, Taywaditap, & Hope, 2000), more than a quarter of respondents endorsed agreement with items reflecting reduced concern about HIV due to new treatments. More important in terms of prevention implications, reduced HIV concern was associated most strongly with sexual risk taking (unprotected anal sex) among HIV-positive participants, suggesting that the availability of combination treatments has had a greater impact on the sexual behavior of men living with HIV.

HIV risk reduction interventions involving persons living with HIV have been limited. Research on HIV counseling and testing suggests that posttest counseling promotes short-term reductions in HIV risk behavior among newly infected men and women (Weinhardt, Carey, Johnson, & Bickham, 1999), but other research reveals continued high-risk behavior among persons with HIV. Taken together, these findings suggest that posttest counseling is not enough. One study tested the effectiveness of providing risk reduction information and emotional support with 271 HIV-positive men and women (Cleary et al., 1995). Results indicated a general decline in sexual risk taking among all participants, but no clear advantage of the risk reduction intervention over the gains observed among control patients who were randomized to a community referral source.

One of the few studies that has evaluated a risk reduction intervention for HIV-positive adults was reported by Seth Kalichman and his colleagues (Kalichman et al., 2001). They compared a five-session, group-based intervention to a contact-matched support group with a sample of 332 men and women

living with HIV. The intervention included skills training (a) to cope with high-risk sexual situations, (b) to disclose HIV serostatus to partners, and (c) to negotiate condom use with sexual partners. The results showed a reduction in risk behavior was observed among HIV-positive participants receiving the intervention to reduce sexual risk behavior, whereas no such reduction was observed in the control group.

Work designed to assist people with emotional adjustment and coping with HIV infection has also demonstrated some risk reduction benefits. For example, Thomas Coates and his colleagues (Coates, McKusick, Kuno, & Stites, 1989) conducted a stress management program for HIV-positive men in San Francisco that included relaxation training, systematic desensitization, physical exercise, and self-management training. Although risk reduction was not a primary goal of the intervention, participation in the program was associated with a reduction in participants' number of partners. Jeffrey Kelly and colleagues (Kelly et al., 1993) reported similar effects using a support group for depressed HIV-positive men. Taken together, these findings suggest that HIV risk reduction counseling is most beneficial if it is included within a broader array of psychosocial services for persons living with HIV.

## HIV VACCINE

There are no vaccines that can prevent HIV transmission. Research investigating candidate vaccines is under way but is expected to require a decade or more to complete.

—Michael P. Carey and Peter A. Venable

See also AIDS AND HIV; AIDS AND HIV: ADHERENCE TO MEDICATIONS IN PERSONS WITH HIV INFECTION; AIDS AND HIV: STRESS; HEALTH PROMOTION AND DISEASE PREVENTION; SEXUALLY TRANSMITTED DISEASES: PREVENTION

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## AIDS AND HIV: STRESS

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The Centers for Disease Control and Prevention estimates that 850,000 to 950,000 U.S. residents are living with HIV, with about 40,000 new HIV infections each year. HIV is the fifth leading cause of death among those ages 25-44; it is the leading cause of death among African American males in this same age range. The development of potent combination antiretroviral therapies for HIV has lengthened life expectancy for HIV-infected persons in the United States. A person with HIV can live for many years without getting AIDS, that is, the occurrence of severe medical symptoms and/or decline in the immune system's helper cells. Despite advances in HIV treatment, there is wide variability in the length of time before a person dies, develops clinical symptoms, or has a weakening in their immune system. Evidence has been mounting that chronic stress may have an adverse effect on the immune system of those infected with HIV, leading to faster disease progression and death.

The Coping in Health and Illness Project (CHIP), conducted by researchers at the University of North

Carolina at Chapel Hill, has reported some of the most consistent and compelling data on the deleterious effects of stressful life events and difficulties in HIV infection. CHIP is a 9-year longitudinal study following 96 HIV-infected gay men who began the study without HIV-related symptoms or HIV medications. To measure stress, the CHIP study uses interviewer-based ratings assessing the severity of patients' stressful life events and difficulties taking into account the circumstances surrounding events (e.g., financial impact, life threat, personal involvement). The objective threat rating is made independently from the subject's rating, to reduce the possibility that worsening disease might lead to poor coping and thus higher stress scores. The measure also excludes stresses that could have resulted from disease progression (e.g., retirement due to HIV worsening). This methodology is one way to avoid the chicken-egg issue of whether stress leads to worsening disease or whether those with declining health rate their stressful events as more unpleasant.

Leserman, Evans, and colleagues from the CHIP study found that men with more stresses during a 9-year period had faster progression to AIDS and faster development of serious HIV-related illnesses (such as pneumocystis pneumonia, Kaposi's sarcoma). Men who had a severe stress at every visit had about twice the risk of progressing compared to men who never had a severe stress. The AIDS progression rate at the end of 8 years for those above average in stress was 74% versus 40% for those below average. The investigators reported similar findings during earlier time periods of the study. Their findings were not explained by differences among patients on such variables as age, race, education, number of HIV medications, or entry levels of helper cells or HIV viral load (amount of virus in the blood).

Another approach to establishing a causal relationship between stress and disease progression has been to study patients who have experienced a major stressor, such as death of a loved one. These types of stressors can clearly be documented before changes in disease status, making the direction of such a relationship less ambiguous (e.g., changes in disease status are more likely to be a result of a major stressor than vice versa). In studying HIV-infected gay men, Kemeny and researchers at the University of California, San Diego, reported that the stress of bereavement prior to their study (having a close friend or lover who died of AIDS) was associated with more rapid decline in helper cell count during a 3- to 4-year period. These findings were

not explained by differences in health habits, HIV medication use, or age; however, bereavement was not related to faster development of AIDS medical symptoms or mortality. In a later study of men during 2- to 3-year follow-up, these researchers showed that those who found meaning in bereavement had less rapid decline in helper cell levels and lower rates of mortality due to AIDS. In studying another stress, being notified of being HIV positive, researchers at the University of Miami found that men with more distress at notification had a greater chance of developing HIV-related clinical symptoms 2 years later.

In one of the few studies of African American HIV-infected women, investigators found that lifetime exposure to traumatic events (e.g., death of child, assault, rape) was associated with greater immune compromise, especially among patients with a psychiatric disorder related to the trauma (e.g., posttraumatic stress disorder). During a 1-year study of 618 HIV-infected children and adolescents, having two or more stressful life events (e.g., death, loss or major illness of family member) was associated with an almost three-fold increased risk of immune suppression (decline in helper cells). These findings were not accounted for by baseline helper cells or demographic variables.

Capitanio and colleagues at the University of California, Davis, have examined the effects of social stress (e.g., unstable social group) on survival of male rhesus monkeys infected with the simian version of HIV (SIV). The animals subjected to an unstable social group (high stress) survived a significantly shorter time (169 days) compared to those in the stable group (low stress). Furthermore, animals that received threats from other animals had higher SIV viral load (more virus in their bloodstream) compared to those not receiving threats, regardless of whether they were in a stable or unstable social group.

Although the research described above gives compelling evidence for a relationship between stress and HIV disease progression, negative findings were reported in several studies using questionnaires to measure stress and using a study design with a short follow-up period. In addition, it is difficult to establish a causal relationship between stress and disease outcome, given that some underlying cause may account for this relationship. Stressful events and trauma, however, appear to have a negative impact on HIV disease progression, especially in studies done over longer time periods and those examining actual stressors (e.g., bereavement) or using interviewer-based ratings of stress.

There is limited evidence that cortisol, a hormone associated with stress, also has a negative impact on HIV infection. Several research groups have reported an association of higher levels of cortisol with poorer immune response, lower helper counts, and faster progression to AIDS and to mortality. These findings remain controversial, and more research is needed to determine whether cortisol might be the link to explain why stress may have a deleterious effect on HIV disease status.

If stressful events are related to HIV disease progression, what is the evidence that interventions aimed at improving coping and reducing distress may improve immunity and ultimately the health status of HIV-infected persons? Although there have been only a few studies addressing this question, researchers at the University of Miami report that both cognitive-behavioral stress management and a bereavement support group appear to improve psychological health and the immune response of persons infected with HIV. These studies have included relatively short follow-up periods, and it remains a question of whether these interventions will have long-term beneficial effects. The available studies suggest that psychological treatments may ameliorate the negative effects of stress, and as such have a salutary impact on the course of HIV, at least in the short run.

To conclude, there is substantial evidence that stress may affect disease progression in those infected with HIV. It must be noted, however, that the majority of studies on stress and HIV infection have been conducted on men, primarily before the advent of protease inhibitors, the most effective HIV medication. Therefore, the findings from the reviewed studies may not apply to women or to those currently taking potent combination HIV medications. If studies continue to show that stress alters the course of HIV infection, it will be important for HIV researchers and clinicians to consider stress management interventions, in addition to medical therapies, to treat this devastating illness.

—Jane Leserman

See also AIDS AND HIV; AIDS AND HIV: ADHERENCE TO MEDICATIONS IN PERSONS WITH HIV INFECTION; AIDS AND HIV: PREVENTION OF HIV INFECTION

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## ALAMEDA COUNTY STUDY

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The Alameda County Study is one of the major research projects that evaluate the effects of health habits in a free-living population. In public health terms, it is a study of social epidemiology. The study originally identified 8,300 adults who lived in 4,735 households. Eighty-six percent of the eligible adults completed questionnaires, and these 6,928 individuals have been followed by the investigators for 25 years.

The study began in 1965, and by the mid-1970s, a variety of interesting findings began to emerge. For example, a series of important analyses demonstrated that health habits were a major predictor of survival for the residents of this urban California community. The specific predictors of surviving (not dying early) included not smoking cigarettes, using alcohol in moderation, being average weight, moderate leisure time physical activity, and obtaining 7 to 9 hours of sleep each night. In some of the analyses, the investigators simply counted the number of good health habits the participants engaged in. They found systematic relationships between the number of these activities and both morbidity (illness) and mortality (early death). For example, those who engaged in none of these practices were 3.11 times more likely to die of heart disease than those who engaged in five of the activities.

The second wave of the Alameda County Study began in 1974. Data were collected from 4,864 of the

original respondents. The study later followed the same individuals in 1994 and 1995. This most recent follow-up provides information on 2,729 of the respondents who had participated in the 1965 and 1994 surveys. The focus on the third follow-up was on health behaviors such as alcohol consumption, smoking, and social activity. The study also provided detailed evaluations on conditions such as diabetes, osteoporosis, hormone replacement, and mental illness. The Alameda County Study, in contrast to many epidemiological studies, focuses on social activities. For example, it included sections on self-care, use of free time, and involvement in social, recreational, and religious activities.

The Alameda County Study also broke new ground by demonstrating the relationship between social support and health outcomes. Those who were more “socially connected” had significantly greater chances of survival than those who were less connected. Among the many important findings from the Alameda County Study is the observation that participation in religious activities was associated with positive health outcomes. However, the relationship between church attendance and health outcomes might be challenged because those who usually attend religious activities may consume less alcohol, have healthier diets, smoke less, or have fewer sexual partners. To investigate this issue, recent publications from the Alameda County Study have provided statistical controls for at least eight other explanatory variables. Even with these controls, there was a statistical benefit of attendance of religious activities. The finding was stronger for women than it was for men.

In summary, the Alameda County Study has provided a significant amount of information on the relationship between behavioral patterns and health outcomes. The study remains active, and we expect continuing important contributions to the literature.

—Robert M. Kaplan

See also BOGALUSA HEART STUDY; FRAMINGHAM HEART STUDY; HARVARD ALUMNI HEALTH STUDY

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## ALCOHOL ABUSE AND DEPENDENCE

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In U.S. general population surveys, approximately 70% of men and 60% of women report drinking on at least one occasion during the previous year. The

majority of drinkers consume light to moderate amounts of alcohol (typically defined as no more than one drink per day for a woman and two drinks per day for a man) and experience few, if any, negative health effects of drinking alcohol. Those negative effects that do occur, such as cognitive impairment and decreased motor skills/coordination, tend to be short term, usually resolving themselves as soon as alcohol is metabolized and removed from the body. Recent research suggests that moderate drinkers may even experience long-term cardiovascular benefits of alcohol.

Among those who have ever consumed alcohol (approximately 92% of the adult population), prevalence surveys suggest that up to 14% eventually develop alcohol dependence. At the higher levels of use that characterize alcohol abuse and dependence, alcohol consumption is related to negative health effects as well as increases in other high-risk behaviors such as smoking and violence. At these higher levels of intake, alcohol can have significant negative effects on health, either directly through the pharmacological and toxic effects of ingesting excessive amounts of ethanol or indirectly through their interaction with other problem and high-risk behaviors.

### WHAT IS ALCOHOL ABUSE?

Alcohol abuse involves alcohol intake that causes problems and is maladaptive. In the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* of the American Psychiatric Association, alcohol abuse is said to occur when the individual experiences impairment or distress related to any one of the following symptoms within a 12-month period: excessive drinking that leads to repeated failures to fulfill responsibilities at work, school, or home; physically hazardous drinking (e.g., while driving); repeated legal problems; and continuing to drink despite alcohol-related social or interpersonal problems.

### WHAT IS ALCOHOL DEPENDENCE?

The *DSM-IV* describes alcohol dependence as involving maladaptively high alcohol intake that produces impairment or distress. Persons diagnosed as alcohol dependent experience at least *three* of the following symptoms within a 12-month period: tolerance (e.g., the need to increase alcohol intake to achieve the desired effects); withdrawal symptoms (e.g., shakiness,

seizures) when alcohol is not available; impairment in the ability to control alcohol intake (e.g., desire for alcohol and lack of success cutting down on alcohol intake); neglect of important activities such as work; large amounts of time spent on alcohol-related activities; and continuing to drink even though experiencing recurring alcohol-related physical and psychological problems.

Although the diagnostic criteria portray alcohol abuse and dependence as categorical phenomena, it is possible to view alcohol consumption and alcohol problems as involving a continuum from no use or problems to heavy drinking and severe problems. Along this continuum there is much heterogeneity in patterns of use and the nature and extent of alcohol problems. Moreover, patterns of use can change over time. Some individuals report a linear progression from social drinking to alcohol abuse followed by dependence. Others exhibit stable patterns of either problematic or nonproblematic alcohol use over time, or move back and forth among patterns (e.g., alternating between long periods of heavy and light drinking patterns).

#### WHAT CAUSES ALCOHOL ABUSE AND DEPENDENCE?

Alcohol abuse and dependence are complex behavioral problems caused by the interaction among a multitude of biological, psychological, and social factors. Individuals vary in the nature and extent to which each of these sets of factors contributes to the development and maintenance of their alcohol problems.

Chief among the *biological factors* are gender and genetics. Women's bodies typically contain less water per unit of body weight than do men. Because alcohol is a water-soluble substance, this physiological difference results in higher peak blood levels of alcohol in women than men per body-weight-adjusted dose. Men and women also differ in their metabolism of alcohol. It appears that these biological differences contribute to women being more vulnerable than men to the potential negative health effects of alcohol consumption. Biological differences, combined with social norms related to women's drinking, generally produce a pattern in which more men than women drink alcohol, and the amount of alcohol consumed by men typically exceeds that consumed by women. Research suggests also that genetic/hereditary factors play a role in the development of alcohol abuse and

dependence. However, the genetic contribution to alcohol-related problems is complex, the specific genes or constellation of genes that contribute to alcohol abuse and dependence have not been identified, and the behavioral implications of identifying the genes that contribute to having problems with alcohol are not clear.

Among *psychological factors*, researchers have suggested that learning from the social environment (i.e., social learning) can play a role in the development of drinking behavior. This occurs both as a function of direct experiences of the positive rewards of drinking (e.g., social acceptance, change in consciousness) and indirect experiences (e.g., seeing alcohol's effects on others). The combination of "risky" temperaments (which include high activity, low attention span, and high emotionality) and difficult family environments has been associated with a range of problem behaviors (e.g., delinquency, aggression) that include early involvement with alcohol and later alcohol abuse and problems. However, the popular lay notion that an "addictive personality" is the cause of alcohol abuse and dependence has not been empirically substantiated. Psychiatric and psychological problems such as schizophrenia, depression, and anxiety disorders are positively associated with alcohol problems. This association has been seen as supporting the notion that some people use alcohol and other drugs to "self-medicate," that is, to relieve negative psychological symptoms so that they feel better.

*Social/environmental factors* that may contribute to alcohol abuse and dependence include drinking norms and practices associated with one's family of origin, ethnic/cultural group affiliation, and religious orientation. Thus, ethnic groups, religions, and families that promote norms for abstinence or light drinking are less likely to produce persons who meet criteria for alcohol abuse and dependence. Similarly, social and economic policies that influence the availability of and access to alcohol (e.g., legal drinking age, zoning of alcohol outlets, taxes on alcohol) also influence patterns of alcohol use and the development of alcohol abuse and alcohol dependence. For example, in the United States, alcohol prohibition during the 1920s and early 1930s produced reductions in the rates of alcohol abuse and dependence. With the repeal of prohibition, rates of alcohol abuse and dependence increased.

Demographic characteristics such as gender, age, and ethnicity are related to a variety of factors ranging



from occupations and attitudes to socioeconomic status (SES). These factors independently and interactively influence drinking patterns and rates of alcohol abuse and dependence. When we consider the role of demographic characteristics in drinking behavior, prevalence data tell us that men drink more (in frequency and amount) than women and that, relative to women, a larger percentage of men are diagnosed as either abusing alcohol or dependent on alcohol. For both men and women, alcohol intake is highest in young adulthood (ages 18 to 25), with gradual decreases as persons become older. Nevertheless, there is a growing concern about drinking problems among the elderly, particularly given the relatively higher prevalence of alcohol abuse and dependence among the large baby boomer generation, which is aging and becoming elderly.

Alcohol abuse and alcohol dependence can be found in all ethnic groups. Although there is much heterogeneity of drinking patterns within ethnic groups (including variations related to age, gender, and SES), prevalence data suggest that rates of alcohol abuse and dependence also vary with ethnicity. For example, a combination of biological, psychological, social/historical, and environmental factors have contributed to higher rates of alcohol abuse and dependence among members of certain Native American groups, while Asian Americans report lower than average rates of alcohol abuse and dependence.

## SHORT-TERM EFFECTS

Alcohol use can have a number of effects on health through its short-term, or acute, effects on behavior. In particular, alcohol's effects on cognitive-motor functioning and decision making increase risk for injury and illness.

### Cognitive and Motor Functioning

Alcohol's acute effects on cognitive functioning are complex and are dependent on the nature of the task, the dose of alcohol consumed, and the time since ingestion. Generally, alcohol-related impairment increases as blood alcohol concentration increases and decreases as alcohol is metabolized and removed from the body. However, the effects at a given blood alcohol concentration can differ depending on whether the concentration is rising or falling (the "biphasic effect" of alcohol). For example, a moderate dose of alcohol

may produce behavioral stimulation and euphoria initially, followed quickly by a sedative effect.

Many behavioral effects of acute alcohol use are thought to be mediated by alcohol's impact on cognitive processing and motor function. For instance, alcohol-induced slowing of reaction times and impairment in ability to perform cognitive tasks (e.g., dividing attention between multiple stimuli) contribute to the increased risk of accidents that accompanies driving after drinking. Under certain conditions, alcohol's short-term effects on cognitive processing may contribute to an increased likelihood of violent behavior, accidents, unintended pregnancy, and sexually transmitted disease infection.

## Violence

Alcohol is commonly cited as a cause of violence. Whether violence takes the form of fights at a bar or football game, physical abuse of a spouse, or even suicide, it is often the case that participants in violence have been drinking. Indeed, it has been estimated that roughly 50% of perpetrators (and victims) of violence have been using alcohol prior to the violent incident. An association between alcohol and violence occurs among varying demographic subgroups, for different types of violence, and even across countries, although the strength of the association varies widely. Research suggests also that the amount of alcohol consumed is related to the severity of the violence.

Despite popular beliefs that alcohol abuse is a cause of violence, the relationship between the two is rather complex and is not unidirectional. Some evidence suggests that alcohol causes violence in certain situations by affecting the way we process information in the brain. For example, according to the "alcohol myopia" theory, alcohol narrows the focus of cognitive processing so that immediate cues and sensations enter awareness, but peripheral cues, including those that inhibit socially inappropriate behavior (such as aggression), do not. Thus, an intoxicated man in a bar may feel angry and start a fight after being accidentally pushed, not thinking that to do so might get him hurt or arrested. An implication of this theory is that alcohol will have its greatest effect on behavior that is subject both to strongly instigating cues (e.g., being shoved) and to strongly inhibiting cues (e.g., fear of being arrested). Without instigation, the behavior is unlikely even if alcohol has been consumed. Conversely, without inhibiting cues, the behavior will likely occur even in the absence of alcohol use.

Other evidence raises the possibility that aggression after drinking sometimes happens because the individual expects alcohol to cause violence and acts in a manner consistent with expectations, like a self-fulfilling prophecy. Drinking and aggression may be linked also because both tend to occur in similar situations, or because personality characteristics that foster heavy drinking also reflect an increased tendency toward violence. The most likely conclusion may be that all of these factors interact to produce the commonly observed link between alcohol use and violence.

### **Injuries**

Beyond its relationship to violence, alcohol use is associated with unintentional injuries stemming from automobile and boating accidents, falls, fires, and similar occurrences. The increased risk of injury likely results from a combination of factors, including impaired cognitive and motor functioning as well as increased risk-taking behavior when drinking. Alcohol also leads to more severe effects when injuries do occur, because of its effect on the heart and circulatory system. As with violence, some types of unintentional injury may tend to co-occur with alcohol use because both drinking and risky behavior are more likely in certain environments and settings (e.g., bars), or among certain demographic subgroups (e.g., young adults). A pattern of binge drinking, in which a large amount of alcohol is consumed during a single drinking occasion, is particularly associated with increased risk for injury, due to the high blood alcohol concentrations reached.

### **Unintended Pregnancy and Infection With Sexually Transmitted Disease**

Risky sexual behavior includes not using birth control, not using disease-preventive measures such as condoms, and being less selective regarding choice of sexual partners. Such behavior often is believed to result from excessive drinking. However, the evidence that alcohol can increase sexual risk taking is inconsistent. The strongest evidence for an effect on condom use, for instance, comes from research with adolescents. Among adults, there is little clear evidence that alcohol use and sexual risk behavior are associated. It may be that among adolescents, alcohol's effects on cognitive processes can more easily disrupt patterns of self-protective behavior such as condom and/or birth

control use, because such patterns are less well established and less habitual than among adults.

### **LONG-TERM EFFECTS**

Over years of use, alcohol's direct and indirect toxic effects in the body can lead to serious negative health consequences. These outcomes are particularly likely with sustained heavy drinking or a pattern of regular (e.g., weekly) binge drinking. These long-term effects occur in several bodily systems, including organs such as the liver that are directly involved with metabolizing alcohol as well as the immune and cardiovascular systems.

#### **Immune Function**

Evidence suggests that alcohol abuse has a complex, negative impact on the immune system, causing both immunodeficiency and autoimmune reactions. For instance, alcohol-dependent individuals often have greatly increased blood levels of immunoglobulins, which are antibodies produced by white blood cells called B-lymphocytes (or B-cells). Although different classes of immunoglobulin have different roles in immune response, higher levels of a given antibody are typically associated with a specific immunity, like that resulting from a vaccination. However, alcohol dependence accompanied by highly elevated levels of immunoglobulin often is associated with immunodeficiency.

Heavy alcohol consumption has direct effects on immune function as well as indirect effects stemming from organ damage (e.g., liver disease). Immune system components affected include T-cells and B-cells, neutrophils and monocytes (from the class of white blood cells called phagocytes), and cytokines (protein molecules secreted by immune system cells). Alcohol's effects on the immune system may explain at least partially why individuals who abuse alcohol are at greater risk for diseases related to immunodeficiency, such as pneumonia, tuberculosis, HIV infection (which eventually leads to AIDS), and hepatitis B and C, as well as diseases related to autoimmunity, such as alcoholic hepatitis, alcoholic cirrhosis, and kidney disease.

#### **Cardiovascular Disease**

Consumption of large amounts of alcohol has acute and chronic effects on the heart and related systems.

Alcohol's effects on cardiovascular disease (CVD) are complex. There is mounting evidence that moderate drinkers exhibit lower levels of CVD-related mortality, suggesting that alcohol has a protective function that is possibly related to increasing high-density lipoprotein (HDL) levels that help to reduce the buildup of cholesterol in the blood vessels. Even so, CVD-related mortality is high among heavy drinkers and binge drinkers. Thus, the *pattern* (i.e., amount and frequency) in which alcohol is consumed along with the overall history of alcohol consumption plays a causal role in CVD.

Acute exposure to large doses of alcohol, as occurs with binge drinking, can precipitate heart attacks or sudden death, particularly among those with a long-term history of alcohol abuse. Evidence from human and animal research suggests four possible physiological mechanisms for producing binge-drinking-related sudden death due to CVD. These include the effects of binge drinking on (1) lipids—binge drinking is associated with increases in low-density lipoproteins (LDLs) and other lipid changes; (2) clotting—alcohol inhibits the aggregation of platelets, thereby making it more difficult for blood to clot; (3) arrhythmia—binge drinking reduces the threshold for ventricular fibrillation and/or scars the myocardium; and (4) hypertension—binge drinking increases blood pressure, particularly systolic pressure. These cardiovascular effects of binge drinking can occur within 12 to 24 hours of heavy alcohol intake. Chronic and more insidious effects of alcohol include cardiomyopathy, which involves enlargement of the heart and loss of the heart muscle's ability to contract. Cardiomyopathy is seen after 10 years or more of excessive drinking and so usually becomes evident beyond the age of 30 years.

## Cancer

Population-based epidemiological research has indicated that as the dose of alcohol increases, so too does risk for developing certain cancers. The heavy drinking that characterizes alcohol abuse and dependence is most strongly related to cancers of the upper digestive system (i.e., the mouth, pharynx, and esophagus). Links between heavy alcohol use and increases in the risk for breast, liver, and colorectal cancers have been suggested, but the research findings are inconsistent and the interpretation of the findings controversial. The mechanisms through which alcohol

contributes to the development of cancers are not well understood. Alcohol may cause cancers directly, through the effects of metabolism by-products such as acetaldehyde, which stimulates bodily reactions that can cause tissue damage. Alcohol also may work indirectly, through its interactions with certain enzymes that increase the toxicity of some carcinogens. For example, alcohol has been found to enhance tobacco's ability to stimulate the growth of tumors in rats. Compared to abstainers, humans who both drink and smoke are at 35 times greater risk for developing cancers of the upper digestive system.

## Liver Disease

Most of the alcohol that an individual consumes is metabolized by the liver. Thus, the liver is susceptible to damage from toxic metabolites such as acetaldehyde, a by-product of alcohol metabolism, which stimulates bodily reactions that can cause tissue damage. Those who meet diagnostic criteria for alcohol abuse and alcohol dependence are at high risk for liver-related illnesses. For example, up to one third of alcohol abusers develop alcoholic hepatitis, and up to one fifth of alcohol abusers develop cirrhosis. Alcohol liver disease is the leading cause of liver-related deaths in the United States. Women who abuse alcohol are more susceptible to alcoholic liver disease than are alcohol-abusing men and have a higher rate of mortality from alcohol-related cirrhosis.

Liver disease is related to increased levels of cytokines, the body's chemical signals that develop in response to injury, infection, or inflammation. These increases can cause injury or death to cells. Increases and/or imbalances in the production of different types of cytokines are related to all three types of liver disease: fatty liver, alcoholic hepatitis, and cirrhosis. As the name suggests, *fatty liver* involves excess deposits of fat in the liver, which often occur as a function of short-term heavy drinking. However, it rarely causes illness and is reversible if the individual stops drinking. Obesity also is a risk factor for fatty liver. *Alcoholic hepatitis* involves inflammation of the liver and death of liver cells. Symptoms include fever, jaundice, and abdominal pain. Even after withdrawing from alcohol, alcoholic hepatitis may not reverse its course and in some cases becomes worse. Alcohol cirrhosis is a progressive liver disease in which the internal structure of the liver becomes scarred and the lobules of the liver become damaged. These

morphological and functional changes can lead to liver failure and death.

Alcohol abuse and dependence also are related to disorders such as the hepatitis C virus (HCV), which also damages the liver.

### Reproduction and Fetal Alcohol Syndrome

Men who meet criteria for alcohol abuse and dependence often experience hormonal changes, such as decreased testosterone, which are associated with decreased libido, impotence, atrophy of the testes, and decreased fertility. Research with male animals has indicated that chronic exposure to alcohol results in fewer offspring, increased mortality of offspring, and lower testosterone levels in male offspring. Women's heavier drinking also has been associated with hormonal changes, although the link between alcohol use and increased levels of estrogen is still being studied. Women who meet criteria for alcohol abuse and dependence often report problems with sexual dysfunction as well as a variety of gynecologic and obstetric problems, including menstrual problems and miscarriages.

One commonly cited long-term health effect of alcohol use occurs not to the individual who consumes the alcohol, but rather to her offspring. Alcoholic women who drink excessively during pregnancy may produce offspring who exhibit a syndrome that is manifested in physical (e.g., growth deficiency, craniofacial defects) and psychological (e.g., mental retardation) deviations relative to children without alcohol exposure. Long-term follow-ups of children diagnosed with fetal alcohol syndrome (FAS) suggest that effects such as poor intellectual and academic functioning (related to their lower than normal IQ), physical problems, and maladaptive behavior continue through adolescence and young adulthood. Less dramatic fetal alcohol effects (FAEs) can sometimes occur for children of women who drink heavily during pregnancy. However, FAEs (e.g., cognitive deficits such as reduced attention and slower reaction times) are quite variable and can be subtle and difficult to diagnose. These variations in the effects of alcohol reflect variations in women's patterns of consuming alcohol (e.g., steady vs. binge drinking), the amounts they consume, and the distribution and metabolism of alcohol in their bodies, as well as the fetal developmental period during which exposure occurs. Conducting and interpreting research regarding the fetal effects of alcohol require consideration of the

contributions of factors other than the toxic effects of alcohol and its metabolites. The lives and pregnancies of heavy-drinking and alcoholic women may be affected by the women's being of lower SES, disruptive/unstable home environments, poor nutrition, the use of other drugs, prenatal infections, and a variety of other factors that contribute to the occurrence of fetal effects associated with FAS and FAE.

—R. Lorraine Collins and Kurt H. Dermen

See also ALCOHOL ABUSE AND DEPENDENCE: TREATMENT

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## ALCOHOL ABUSE AND DEPENDENCE: TREATMENT

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Despite advances in its understanding and treatment, alcohol abuse remains a challenge for individuals and professionals, as well as an important public health problem. Treatment for alcohol abuse has a long and complex history. Over time, many models have been proposed to conceptualize and explain alcohol abuse and its problematic effects, as well as to guide the development of treatment approaches.

In the past, treatment practitioners often were trained to employ only one treatment modality based on the disease model of alcoholism, whereas presently, an eclectic approach is considered most appropriate. Furthermore, the use of single, traditional paradigms have often failed to address the complexity of the individual's motivation to change. Providing treatment appropriate to an individual's readiness to change, as well as co-occurring disorders, and designing a treatment plan that is most effective for the individual, may prove most helpful. The following list of brief descriptions of various treatment approaches is by no means exhaustive, but should give the reader an idea of what is available.

## SELF-HELP

Utilizing personal resources or seeking the help of others with similar problems, referred to as *self-help* or *mutual aid*, has become a common source of assistance for individuals with alcohol problems. Support may be found in a group format with other recovered or recovering problem drinkers, such as with Alcoholics Anonymous (AA), the earliest contemporary and most well-known self-help organization, founded in 1935 with groups throughout the world. AA and similar groups often have several things in common, such as voluntary participation, membership for anyone who wishes to stop drinking, and a variety of meeting formats, which may include speakers. Many self-help groups such as AA employ a 12-step model toward recovery, with members following the 12 steps with abstinence as the primary goal, as they receive strong support and ideas for how to cope with life's problems without alcohol. In addition, family members and friends may attend their own support groups.

AA may be differentiated from other group models by its emphasis on abstinence as the only viable goal, as well as its conceptualization of alcoholism as a disease for which individuals do not have voluntary control. In addition, AA is a spiritual fellowship where members rely on a "higher power" to help them through recovery. Examples of the 12 steps to recovery are Step 1, We admitted we were powerless over alcohol—that our lives had become unmanageable, and Step 5, Admitted to God, to ourselves and to another human being the exact nature of our wrongs.

Smart Recovery (SR), originally based on the work of Albert Ellis and "rational recovery," is another self-help program that uses professional assistance in addition to role models and fellow members who are working to change or already have changed their own drinking behavior. Unlike AA, SR emphasizes self-reliance rather than reliance on a higher power. Other key components of SR are enhancing motivation, learning to refuse to act on urges, managing life difficulties in a sensible manner without alcohol or other substances, and developing a healthy and balanced lifestyle overall. Furthermore, SR does not view addiction as a disease, but rather as a complex maladaptive behavior over which one has control and can change. To aid this change, a cognitive-behavioral (thinking/doing) strategy is used to help people learn to manage beliefs and emotions that lead to drinking.

Other self-help groups offer flexibility in goals for changing drinking behavior, supporting an individual's choice to choose abstinence or moderation. Moderation Management (MM) is an example of such a program. It employs a behavioral change model and a national support group network for people who have decided to reduce their drinking and make other positive lifestyle changes. MM empowers individuals to accept personal responsibility for choosing and maintaining their own path. The program also promotes early self-recognition of risky drinking behavior, when moderation is an achievable goal. MM provides information about alcohol, drinking guidelines and limits, drink monitoring exercises, goal setting techniques, and other self-management strategies. Members also follow a nine-step paradigm to help them achieve balance in other areas of their lives. Furthermore, harm reduction is seen as a worthwhile goal, particularly when the complete elimination of harm or risk is not a realistic option.

## PROFESSIONAL TREATMENT

### Outpatient

Although residential treatment is available, the majority of professional assistance for alcohol abuse and related problems occurs in outpatient settings, such as in clinics or medical centers.

Brief interventions entail minimal intervention by a professional, usually only a few hours, and have mostly been used with individuals who do not have more severe alcohol problems. Brief interventions often include a motivational enhancement component and personal assessment feedback about drinking patterns. The content of brief interventions varies, with many including training in coping skills, identifying cues that may lead to drinking, and refusal skills. For example, primary health care physicians may employ motivational interviewing when a patient screens positive for problematic alcohol use. Motivational interviewing is a way to help people recognize their present or potential problems and encourage them toward change when they might be ambivalent or reluctant. College campus-based programs are another example of brief interventions, where students learn skills to help them cope with peer pressure and make healthier and safer alcohol-related choices.

Behavior therapy techniques are based on the principles of classical and operant conditioning,

where drinking is defined as a learned behavior that can be modified using behavioral interventions. With operant conditioning, positive reinforcement and negative reinforcement shape the strength of associations with alcohol. Drinking may be positively reinforcing because of its euphoric effects, or it may be negatively reinforcing by reducing feelings of tension. Classical conditioning operates through the pairing of stimuli. Just as Pavlov's dogs began to salivate to only the sound of a bell after the bell sound had previously been paired with the presentation of food, heavy drinkers often have an automatic, conditioned response to alcohol cues, which enhances craving and consumption. Examples of different behavioral strategies based on operant and classical learning include cue exposure and aversion therapies. In cue exposure, based on operant conditioning, individuals are exposed to external and internal cues that often lead to drinking, such as a craving for alcohol in a particular place (e.g., a bar) or a craving in response to anxiety. With graded increases of prolonged exposure, the cue loses its potency in the extinction process and no longer compels the individual to drink. Often therapists may teach individuals how to cope with urges or cravings that are associated with cue exposure. Aversion therapies are intended to develop a classically conditioned aversive response to alcohol, and may involve sight, taste, smell, or thoughts of alcohol. The oldest of these strategies involves pairing drinking with a nausea-inducing agent, such as an emetic medication. Through classical conditioning, the individual develops nausea in response to alcohol.

Cognitive approaches to treating alcohol operate under the assumption that thought patterns contribute to increased drinking and psychological dependency on alcohol. For instance, negative mood states that cue drinking may result from misperceptions of events and negative thinking. A simple example is thinking about a difficult day; one may think, "I've had a hard day, how terrible. I owe myself a drink." Such thoughts occur automatically and often precede habitual behavior. Cognitive therapies teach individuals to identify automatic thoughts, to devise alternative constructions, and to change subsequent drinking.

Cognitive approaches also inform individuals about how their expectancies and attributions about the effects of alcohol contribute to drinking. For example, many people expect alcohol to produce pleasurable effects. This may encourage drinking and

reliance on alcohol as a "magic elixir" that transforms life's daily hassles into a "golden glow."

In cognitive-behavioral treatment, cognitive methods are combined with behaviorism. For example, with a relapse prevention approach, patients learn to anticipate and cope with situations in which there is a high risk for relapse (e.g., feeling angry). Here the patient is taught an effective coping strategy (e.g., anger management skills) as an alternative to drinking. In addition, behavioral homework assignments where an individual enters progressively more risky situations while exercising alternative coping skills assist an individual to maintain his or her treatment goals. If relapse occurs, an individual modifies his or her attributions about why the relapse occurred, focusing on the event as a "mistake" as opposed to a "loss of control."

Another avenue for treatment involves significant people in the drinker's life. Relationship therapies, such as with family members or partners, attempt to reduce drinking problems by improving the quality of relationships. Many problem drinkers experience extensive difficulties in their primary relationships. Drinking behavior is often related to such difficulties, in that individuals may drink to cope with problems, and drinking may directly contribute to such problems. A common behavioral approach in relationship therapies is to teach better communication skills and increase positive reinforcement within the relationship. Positive marital and family adjustment is associated with better treatment outcome.

Pharmacotherapies come in two forms. First, antidipsotropic medications, also known as alcohol-sensitizing or deterrent drugs, are used to deter drinking by producing an unpleasant reaction if the person ingests alcohol. One commonly used medication for this purpose is disulfiram or Antabuse. Following ingestion of alcohol, a person taking disulfiram may experience dizziness, flushing, nausea, vomiting, and other reactions. Such medications are not primary treatment by themselves, but are intended for use in multimodal programs. Second, pharmacotherapy may also involve the use of psychotropic medications to decrease cravings, treat co-occurring disorders such as depression, or lessen the severity of withdrawal. Psychotropic medications, such as Naltrexone and benzodiazepines, are also intended as adjuncts to behavioral and psychosocial therapies.

Finally, the community reinforcement approach (CRA) to treatment for alcohol problems focuses on

replacing the rewarding aspects of drinking with the rewarding aspects of sobriety. CRA is a behaviorally based, intense approach with rapid interventions affecting many areas of a person's life. For instance, a CRA program may include antidipsotropic medication, relationship counseling, vocational assistance, and social skills training. This approach also provides a method of assistance through a concerned family member or other individual when the drinker is not willing to seek treatment.

### Inpatient

Residential treatment was once considered state-of-the-art treatment and often employed before less intense forms of intervention. Now, residential treatment is considered most appropriate for individuals who have co-occurring disorders, are a risk for suicide or pose a violent risk to others, or have more serious health problems that would benefit from residential care. The standard model, often referred to as the Minnesota model, was created in a state mental hospital in the 1950s and spread first to a small not-for-profit organization called the Hazelden Foundation and then throughout the country. The key elements of this treatment method are an in-facility stay of up to 28 days; an abstinence-based, 12-step approach involving group and individual therapy; and a blending of professional and trained nonprofessional (recovering) staff. This approach is no longer widely used due to managed care, lack of insurance, and no evidence of its superiority over outpatient and alternative science-based treatments.

### Selecting a Treatment Approach

How does one choose the best treatment modality and setting? Research has been limited in addressing the question of which approach is best. Studies with sound methodology are sparse, and those with strong methodology have produced contradictory findings. One prominent, long-term study, Project MATCH (Matching Alcohol Treatments to Client Heterogeneity), compared three different treatment modalities, cognitive-behavioral therapy (CBT), motivation enhancement therapy (MET), and 12-step facilitation therapy (TSF), matched to a range of different client groups. At 2- and 3-year follow-ups, researchers found no differences among the three modalities. The only predictor was therapeutic alliance.

Therefore, if matching is not demonstrated, perhaps we need to introduce more consumer options, a menu of treatment choices. It may be best to combine different approaches based on assessment of the individual, and to employ a stepwise model, addressing motivation for change. We must recognize the usefulness of integrating different approaches and provide the individual seeking help with accurate, honest descriptions of the options available. Individuals then may choose which approach works best for them, and move on to another approach if that one does not help or fit the individual.

—G. Alan Marlatt and Sandra Radin

See also ALCOHOL ABUSE AND DEPENDENCE;  
TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

### Further Reading

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## ALLOSTASIS, ALLOSTATIC LOAD, AND STRESS

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There is a need to develop a biological framework in which to conceptualize and measure the cumulative impact of social status, income, education, working and living environments, lifestyle, health-related behaviors, and stressful life experiences on physical and mental health and the progression of a number of diseases. Such a framework would aid social scientists in studying important questions, such as how socioeconomic status (SES) gets "under the skin" and affects health. This has been a major effort within the MacArthur Foundation Research Network on Socioeconomic Status and Health.

One of the main challenges has been to expand beyond the limitations and ambiguities imposed by the terms *stress* and *homeostasis*. This entry discusses the physiology of the response to stress in terms of a new formulation involving two concepts, namely,

*allostasis* and *allostatic overload*. We believe that these two terms allow for a more restricted and precise definition of *stress* that refers to an event or series of events that evoke a set of behavioral and physiological responses. These terms also clarify inherent ambiguities in the concept of homeostasis, and we also note the ways in which they replace and clarify aspects of the “general adaptation syndrome” as formulated by the late Hans Selye. A primary reason for clarifying terminology is to allow development of a more relevant set of measurements of the biological states that are related to resilience or to disease. Besides discussing the concepts and pathophysiology associated with allostatic overload, this entry also discusses the choice of biological mediators that can be measured in body fluids or by other relatively simple and noninvasive means on human subjects.

## DEFINITION OF TERMS

*Stress*—a threat, real or implied, to homeostasis. Stressors are those events and experiences that evoke behavioral and physiological response that initially protect and reduce the danger.

*Homeostasis*—stability of physiological systems that maintain life; used here to apply strictly to a limited number of systems such as pH, body temperature, glucose levels, and oxygen tension that are truly essential for life and are, therefore, maintained over a narrow range.

*Allostasis*—achieving stability through change. A process that maintains homeostasis (see above), even though the “set points” and other boundaries of control may change with environmental conditions. There are primary mediators of allostasis such as, but not confined to, hormones of the hypothalamic-pituitary-adrenal (HPA) axis, catecholamines, and pro- and anti-inflammatory cytokines.

*Allostatic state*—altered and sustained activity levels of the primary mediators (see above) that integrate energetic and associated behaviors in response to changing environments, challenges such as social interactions, weather, disease, predators, pollution, and so forth. Originally proposed for understanding physiological aspects of drug abuse, an allostatic state results in a chronic imbalance in the primary mediators reflecting excessive production of some, and inadequate production of others. Allostatic states can be sustained for limited periods if food intake and/or stored energy such as fat can fuel homeostatic

mechanisms (e.g., bears and other hibernating animals preparing for the winter).

*Allostatic load and allostatic overload*—*Allostatic load* is the cumulative result of an allostatic state (e.g., fat deposits in a bear preparing for the winter). Within limits, it is part of adaptive responses to seasonal and other demands. However, with additional unpredictable events in the environment, disease, and adverse social interactions, allostatic load can increase dramatically. When allostatic load continues for longer periods and becomes independent of the need for survival, then symptoms of *allostatic overload* appear. Abdominal obesity is an example of this condition.

## WHAT DO WE MEAN BY STRESS?

Stress is often defined as a threat, real or implied, to homeostasis, and homeostasis refers to the maintenance of a narrow range of vital physiological parameters necessary for survival. In common usage, stress usually refers to an event or succession of events that cause a response, often in the form of “distress” but also to a challenge that leads to a feeling of exhilaration, as in “good” stress. But the term *stress* is full of ambiguities. It is often used to mean the event (stressor) or, sometimes, the response (stress response). Furthermore, it is frequently used in the negative sense of “distress,” and sometimes it is used to describe a chronic state of imbalance in the response to stress. Here, *stress* will be used to refer to the *stressor*, that is, events that are threatening to an individual and that elicit physiological and behavioral responses.

The most commonly studied physiological systems that respond to stress are the HPA axis and the autonomic nervous system, particularly the sympathetic response of the adrenal medulla and sympathetic nerves. These systems do more than respond to stressors even though they are frequently identified as “stress responsive systems.” They have a housekeeping function and play an important role in the diurnal rhythm of sleep and waking activity. They are elevated by lifestyle factors such as diet, alcohol consumption, smoking, and sleep deprivation. Stressful experiences can cause sleep loss and promote drinking, smoking, and overeating, thus compounding the activation of the HPA axis and sympathetic nervous system by the stressor itself. Another type of reaction to a potentially stressful situation is enhanced anxiety, particularly



when the threat is ill-defined or imaginary and when there is no clear alternative behavioral response that would end the threat. The HPA axis and sympathetic responses act as a “funnel” and final common path through which all of these influences converge to affect an individual’s physiology.

## HOMEOSTASIS AND ALLOSTASIS

Homeostasis, in a strict sense, applies to a limited number of systems such as pH, body temperature, and oxygen tension that are truly essential for life and are, therefore, maintained within a narrow range, as a result of their critical role in survival. These systems are not activated or varied in order to help the individual adapt to its environment. Other systems that vary according to demand, such as the HPA axis and autonomic nervous system (ANS), actually help maintain those systems that are truly homeostatic. Moreover, large variations in the HPA axis and ANS do not lead directly to death as would large deviations in oxygen tension and pH.

Allostasis is a term first introduced to characterize how blood pressure and heart rate responses vary with experiences and time of day and also to describe changes in the set point of these parameters in hypertension. The change in set point was used as the primary example that distinguishes allostasis from homeostasis. Yet there is a much broader implication, namely, that allostasis is the process for actively maintaining homeostasis. Therefore, allostasis is a much better term for physiological coping mechanisms than is homeostasis, which should be reserved for the parameters that are essentially maintained for survival. Allostasis also clarifies an inherent ambiguity in the term homeostasis and distinguishes between the systems that are essential for life (homeostasis) and those that maintain these systems in balance (allostasis).

## FROM ALLOSTASIS TO ALLOSTATIC STATES, ALLOSTATIC LOAD, AND OVERLOAD

The HPA axis and sympathetic nervous system are two of the major systemic mediators of allostasis, and their secretions occur according to two major patterns: (1) in response to challenge or demand, as in stressful experiences, or (2) as part of a housekeeping function that is governed by such things as the day-night light-dark cycle. When the response pattern is either elevated or reduced in a persistent way, we call it an *allostatic state*. The overexposure or underexposure to

mediators of allostasis results in various types of cumulative change (*allostatic load*) that can lead to pathophysiology (*allostatic overload*). Four types of allostatic states are recognized.

First, chronic stress promotes allostatic load and overload (“repeated hits”). For instance, people who have had excessive stress in their lives, as measured by multiple periods of poverty-level income, show earlier aging, more depression, and an earlier decline of both physical and mental functioning. Second, most people show adaptation of physiological responses with repetition of the same type of stressor, but others do not (“lack of adaptation”); this results in an overexposure to mediators; for example, measurement of cortisol in a repeated public speaking challenge revealed individuals who did not habituate, and these individuals, who lack self-confidence and self-esteem, may well be overexposing their bodies to stress hormones under many circumstances in daily life that do not overtly disturb other individuals. Third, allostatic states also include patterns of response that are distorted, for example, impaired shut off or an elevated or a flattened diurnal rhythm of the mediator (“prolonged response” and “inadequate response”). These response profiles may be influenced by genetic factors, early developmental influences, or the effects of lifestyle and may be distorted by overuse into abnormal temporal patterns in which the body fails to efficiently manage the response to challenges or maintain a normal diurnal rhythm. As one example of a prolonged response, individuals with a genetic load, that is, two parents who are hypertensive, show prolonged elevation of blood pressure in the aftermath of a psychological stressor. Another example pertains to the diurnal rhythm, which is normally elevated in the morning and low in the evening: Reduced amounts of sleep for a number of days results in elevated cortisol levels during the evening hours. Sleep deprivation and elevated diurnal levels of cortisol are also features of major depression. In depressive illness, loss of bone mineral density has been reported that is linked to elevated diurnal glucocorticoid levels. The loss of bone minerals and muscle protein are two of the recognized consequences of chronic elevation of glucocorticoids. The elevation of cortisol in the evening also causes dysregulated glucose metabolism with evidence of a hyperglycemic state.

An example of an inadequate response occurs when the glucocorticoid response is inadequate to the needs of the individual genotype, resulting in excessive activity of other allostatic systems such as the inflammatory cytokines, which are normally

contained by elevated levels of cortisol and catecholamines. For example, Lewis rats, which have a genetic deficiency in glucocorticoid levels, are vulnerable to inflammatory and autoimmune disturbances that can be overcome by giving exogenous glucocorticoids. Comparable human disorders in which lower-than-needed cortisol may play a role include fibromyalgia and chronic fatigue syndrome.

Allostasis and allostatic load are organizing principles that apply to many biological mediators. Protection or damage are the extreme consequences of the release of mediators of allostasis, such as adrenal catecholamines and glucocorticoids, which provide some of the best examples to date of allostasis and allostatic overload. Other mediators in the blood are the adrenal androgen, dehydroepiandrosterone (DHEA), and the pro- and anti-inflammatory cytokines that are produced by immune cells and other cells and tissues throughout the body. Whereas DHEA is a functional antagonist of glucocorticoid actions, the cytokines are mediators that regulate the immune response and also play a major role as hormones involved in tissue inflammation and oxidative stress.

Although mediators in blood are the ones that are most frequently sampled in studies on human subjects, it is important to note how tissue mediators of allostasis also play an important role in allostatic load and overload. For example, the increase in levels of extracellular glutamate in the hippocampus during restraint stress is involved in remodeling of dendrites of hippocampal pyramidal neurons. This mechanism becomes less efficient as rats age. When aging rats are subjected to restraint stress and microdialysis, there is an exacerbation of both the level of extracellular glutamate and a prolongation of the response after the stress is terminated. This constitutes an example of an allostatic state in which the elevation of a mediator of allostasis fails to go back to baseline when the stressor is finished. This pattern of prolonged response can lead to allostatic load at the tissue level, since the elevated glutamate is likely to potentiate the morphological and other effects that occur through activation of NMDA and other excitatory amino acid receptors. Allostatic overload in the hippocampus involves damage and neuronal loss.

#### MEASUREMENT OF ALLOSTASIS, ALLOSTATIC STATES, AND ALLOSTATIC LOAD

How can we measure allostasis and its consequences in terms of allostatic states and allostatic

load, particularly when it comes to following the events that lead to disease over the life course in individual human subjects and groups of individuals? This is a major goal of the biologist in working with social scientists in attempting to answer questions, such as the relationship between working, living environments and socioeconomic conditions and health or disease. It is one of the main reasons that the definition of terms should be made more precise. The distinction between allostatic states and allostatic overload provides two different types of endpoints that can be measured, at least in principle. Allostatic states refer to the response profiles of the mediators themselves, whereas allostatic overload focuses on the tissues and organs that show the cumulative, pathophysiological effects of overexposure to the mediators of allostasis, either because of too much stress or because of perturbation of the housekeeping functions of these mediators. This section will briefly consider the challenges and opportunities in measuring allostatic states and allostatic load.

For determining different allostatic states in human subjects, the choice of which mediators to measure depends, in large part, on where in the body one is able to measure them as noninvasively as possible. This can be done most easily by collecting urine or saliva, but, if necessary, blood, and rarely and under special circumstances, cerebrospinal fluid can be obtained.

The choice is dictated by such factors as the size of the study, cost of the assays, and not wanting to disrupt the lives of the subjects under study more than absolutely necessary in order to ensure cooperation and minimize added stress and anxiety that can influence the secretion of the mediators being measured. This limits the choice to the circulating mediators such as glucocorticoids, DHEA, catecholamines, and certain cytokines. Salivary assays are particularly attractive, but then the question arises as to how to sample over time to get an adequate representation of a dynamic system, since the levels of the mediators may fluctuate during the day and night. This is a topic unto itself and has been the subject of a number of methodological studies (see Web site for MacArthur SES and Health Research Network: [www.macses.ucsf.edu/](http://www.macses.ucsf.edu/)). Portable monitoring of blood pressure and heart rate provide complementary information to the measurement of mediators in body fluids. The ease of such measurements also explains why the study of cardiovascular function as an endpoint of disease has

progressed so far relative to other systems of the body that are sensitive to stress and show allostatic load.

As far as assessing allostatic overload, the fundamental issue is determining which parameters best assess cumulative pathophysiological changes in key systems, such as the heart and brain. Endpoints, besides the mediators discussed above, that have been used for cumulative assessment of allostatic overload in different systems of the body, include waist-hip ratio, glycosylated hemoglobin and cholesterol and HDL. Other cumulative measures include measurements of shrinkage of key brain structures like the hippocampus and assessments of bone mineral density and skeletal muscle mass.

In previous research, Seeman and colleagues have demonstrated that an initial operationalization of allostatic load, based on information reflecting functioning of the hypothalamic-pituitary-adrenal axis, sympathetic nervous system, cardiovascular system, and metabolic processes, is related to risks for a range of different pathology, including risks for incident cardiovascular disease, declines in cognitive and physical functioning, and mortality. The initial index of allostatic overload (AL) was designed to summarize levels of physiological activity across multiple regulatory systems pertinent to disease risks and was based on an algorithm whereby, for each of 10 biological parameters, subjects were classified into quartiles based on the distribution of scores in the cohort. AL was measured by summing the number of parameters for which the subject fell into the “highest” risk quartile (i.e., top quartile for all parameters except HDL cholesterol and DHEA-S for which membership in the lowest quartile corresponds to highest risk) so that the range of possible scores was 0 to 10. More recently, Seeman and colleagues have explored alternative approaches to summarizing information across these multiple biological parameters, including canonical correlation analyses, which incorporated the full range of biological values for each parameter and allowed for unequal weighting of the various parameters. Results of these latter analyses demonstrated even stronger associations between the summary measure of allostatic load and prediction of subsequent risks for decline in cognitive and physical functioning.

In addition to such evidence, linking various indices of allostatic overload to subsequent health risks, research has also demonstrated that differences in AL among middle-aged and older adults are related in expected ways to both SES, as well as differences

in social conditions (e.g., levels of social integration and social support)—higher SES and better social conditions being associated with lower allostatic load. These findings have also been replicated in a younger cohort (ages 18-32) where parental SES (measured in terms of educational attainment) has been found to be negatively associated with a summary index of cardiovascular risk in Caucasians.

Clearly, the measures of AL outlined above represent only an initial, and only partial, assessment of the concept. Further evaluation of the concept of allostatic overload will require attention to a number of issues related to measurement. First, what would be the a priori set of component measures needed to comprehensively assess AL (i.e., which regulatory systems and which parameters of those regulatory systems, including both system dynamics and system “state/level” assessments)? Measurements of AL based on work by Seeman and colleagues have, to date, not included assessments of hemostatic or inflammatory parameters, or assessment of parasympathetic activity; nor do they encompass assessments of system dynamics.

A second issue for future research concerns the procedures for developing optimal operational measures of AL from these component measures. Previous research has relied largely on linear analysis techniques. Future research is likely to gain from exploration of the potential value of more nonlinear techniques such as recursive partitioning that permit identification of nonlinear patterns of association between the various components of AL and greater versus lesser health risk.

—Bruce McEwen and Teresa Seeman

See also CARDIOVASCULAR REACTIVITY; GASTRIC ULCERS AND STRESS; HEART DISEASE AND REACTIVITY; HOSTILITY; PSYCHOPHYSIOLOGY; METABOLIC SYNDROME AND STRESS; PEPTIC ULCERS AND STRESS; PSYCHONEUROIMMUNOLOGY; PSYCHOPHYSIOLOGY: THEORY AND METHODS; STRESS: BIOLOGICAL ASPECTS

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## ALTERNATIVE MEDICINE.

**See** COMPLEMENTARY AND  
ALTERNATIVE MEDICINE

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## ALZHEIMER'S DISEASE: PSYCHOSOCIAL ASPECTS FOR CAREGIVERS

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Alzheimer's disease (AD) is one of the most significant health issues in late life, affecting the health and well-being of both individuals and their families. Currently, the estimates of prevalence of AD in the United States range from 2.7% to 11.2% for people 65 years of age or older, or approximately 1.5 to 6.1 million individuals. Importantly, 75% of all dementia victims who are 65 years of age or older have AD. Estimates of the direct costs of AD, including nursing

homes, long-term mental hospitals, paid home care, physician care, acute hospital care, and caregiver medical care, exceed \$60 billion per year in the United States. Yet the costs of AD extend beyond the financial toll.

## ALZHEIMER'S DISEASE DIAGNOSIS

AD is an age-related disease that involves the gradual onset of progressive global intellectual and functional deterioration. It is diagnosed primarily using the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* criteria. Persons with AD have impaired short-term memory, attention span, and cognition, especially abstraction, calculation, judgment, and spatial relations. They also can exhibit affective problems, such as depression, and anger, as well as behavioral problems, such as agitation, paranoia, wandering, and aggression. During differential diagnosis, AD is distinguished from short-term loss of intellectual function, delirium, vascular disease, focal neurological signs, myocardial infarction, alcoholism, major psychiatric illness, degenerative neurological diseases, chronic renal, hepatic, pulmonary, or endocrine disease, and central nervous system disorders.

The course of AD, ranging from 4 to 15 years, is characterized by a progressive decline in cognition, affecting multiple functional domains—ability to manage activities of daily living (ADLs), social and emotional competence, judgment and decision making, way-finding, memory, language, and ultimately, control of physical functions (e.g., walking, continence). Because AD affects all aspects of functioning, this disease has significant implications for families, who provide the vast majority of care.

## PSYCHOSOCIAL IMPLICATIONS OF ALZHEIMER'S DISEASE

During the early phases of AD, the individual is aware of changes in cognition, and commonly experiences emotional responses of denial, anger, fear, anxiety, and sadness. With progression, other psychosocial symptoms can emerge, including comorbid depression and anxiety, agitation, lowered stress threshold, and social withdrawal.

Most family caregivers of persons with AD face years of continuous exposure to physical and psychosocial demands. Caregiving represents not only

the donation of time and energy but also potential loss of income and/or accrued benefits when caregivers make work adjustments to accommodate their role. Many working caregivers change work schedules, while a small percentage take a leave of absence, seek a less demanding job/fewer hours, or give up work. Almost half of all caregivers are adult children, the "sandwich generation," who are providing support to both younger and older family members, while at the same time dealing with competing demands of employment and other activities.

By providing over 80% of all long-term care, family caregivers make a substantial contribution, offsetting the potential expenditures should older adults require formal services instead. The market value of this care by unpaid family members and friends was estimated to be approximately \$196 billion in 1997, dwarfing concurrent national spending on formal home health care (\$32 billion) and nursing home care (\$83 billion).

Caregiving also poses physical, psychological, emotional, social, and financial burdens. The diagnosis of AD is an acute stressor that yields short-term psychological distress; however, the diagnosis is revisited and its effects are chronic as the AD unfolds and the caregiver experiences ongoing reactions. Depression is a fairly common outcome of caregiving, occurring at rates higher than the general population, with estimates ranging from 7% to 36% of caregivers. Responses to the caregiving situation vary considerably, depending on caregiver vulnerability and strengths, the demands of the care situation, social support, characteristics of the care recipient, the type and quality of the dyad's relationship, and health.

## PHYSICAL HEALTH IMPLICATIONS OF ALZHEIMER'S DISEASE

One would expect a number of caregivers to be at elevated risk for health problems because chronic stressors are associated both with illnesses and with disease progression in persons who are already ill. In fact, caregivers may experience prolonged anticipatory bereavement over lost aspects of their relationships with their care recipients, and bereavement is positively associated with physical illnesses, health care utilization, and mortality. Unfortunately, for many years, caregiver research focused more on psychological rather than on physical health problems, and with the advent of research on physical health, the

primary emphasis was on self-reported health. This included global health, and reports of medication use, symptoms, utilization of health care, and illnesses. Relationships between caregiving and reported health were expected because strong positive relationships exist between caregiving and psychological distress and between distress and reported health problems.

Other pathways may, however, also predict relationships of caregiving with illness. For example, it is well known that chronic stress and bereavement are associated with elevated physiological risks and that such risks may arise in several ways. In one pathway, distress triggers risky behaviors, such as poor diet, sedentary behavior, and substance abuse, which elevate physiological risk. In another pathway, chronic stress leads to psychosocial distress and then to elevated stress hormones. This occurs via the hypothalamic-pituitary-adrenal axis, from which CRH-ACTH-cortisol are secreted, and the sympathetic adrenomedullary axis, from which norepinephrine and epinephrine are secreted. These hormones stimulate peripheral activity, which can lead to *allostatic load* or wear-and-tear from repeated arousal and inefficient control of physiological responses. Such compensation may lead to pathophysiology. These pathways contribute to illness by increasing cardiovascular, metabolic, or immunologic dysregulation, and they help to explain why depression, sleep problems, and risky behaviors increase a caregiver's risk for illnesses. Indeed, caregivers report more sleep problems, poorer diets, and sedentary behaviors than do noncaregivers.

In terms of physiological functioning, research on caregivers began only 15 years ago. Since then, studies have assessed stress hormones and neurotransmitters, immunologic, cardiovascular, and metabolic functioning. A recent quantitative review examined 23 independent studies from around the world that compared physical health indicators in 1,594 family caregivers of persons with dementia to health indicators in 1,478 age- and gender-matched noncaregivers. Overall, caregivers showed poorer self-reported health. Furthermore, across several studies, caregivers had a 23% higher level of stress hormones (e.g., cortisol) and a 15% lower level of antibody responses than did noncaregivers. Physiological reactions to elevated stress hormones, such as elevated blood pressure and glucose, may increase a caregiver's risk for hypertension and diabetes. Moreover, suppressed antibody production may be serious because the mean age

of caregivers and noncaregivers in this review was 65.1 years. Older adults are at higher risk for influenza, and their responses to vaccination are lower than in younger adults. The results of this review may partially explain why one study showed that over an average of 4.0 years, spouse caregivers were, in fact, more likely to die than spouse noncaregivers.

## IN SEARCH OF THEORETICAL MODELS

Although research on caregiver health has steadily increased in the past decade, few attempts have been made to use a theoretical model to unify this work. Such models may help researchers and policymakers to focus on those caregivers at greatest risk for health problems, that is, those caregivers who contributed most to the differential percentages cited above. The fact is, the majority of caregivers may not find caregiving highly distressing, but ongoing demands and exhaustion, particularly for frail caregivers, can result in deleterious health outcomes for those who are vulnerable.

One explanatory model attempts to focus on these caregivers. It considers pathways that interrelate caregiver stressors, psychosocial distress, risky health habits, physiological mediators, and subsequent health problems. Importantly, it includes individual differences, such as vulnerabilities and resources, which moderate relationships of stressors with distress. Here, vulnerabilities are enduring hard-wired influences such as personality, gender, ethnicity, family history, trait anger, and comorbidities. In contrast, resources are more mutable and affected by the person and the environment. These include social supports and coping. Interactions of vulnerabilities and resources with exposure to stressors (caregiving) are expected to influence illness over and above the direct effects of any one of the variables. Indeed, in one study caregivers with high vulnerability and low resources had greater burden 15-18 months later than did those with either low vulnerability or high vulnerability and high resources, even after controlling baseline burden. One would expect such distress to result in greater illness risks for these caregivers.

## CAREGIVER VULNERABILITIES AND RESOURCES

Demographic variables, such as a caregiver's age, relationship to the care recipient, and gender, may be particularly relevant to his or her risk of illness.

Interestingly, the direction of moderation is not obvious for age and one's relationship to the care recipient. Although older persons have less resistance to illness, caregiving may be more developmentally on time for older than for younger caregivers. Also, partners may be frailer, more isolated, and more distressed than other caregivers, but caring for a partner might be viewed as a marital commitment. In contrast, caring for a parent might pose conflicts of equity when one must choose between parents and partners/children.

Relationships of caregiving with self-reported health are greater for older participants, perhaps because of the increase with age of physical illnesses and disabilities, which might be exacerbated by psychosocial distress, a strong correlate of self-reported health. One might expect gender to be a moderator of caregiver health because women report more distress and health problems, and they utilize more health care than do men. Alternatively, men exposed to laboratory stressors show larger and more consistent increases in stress hormones, neurotransmitter metabolites, and blood pressure than do women. This may be further exacerbated when faced with a stressor, such as caregiving, which is "gender-inconsistent" with traditional men's roles. Finally, widowers appear to have more illnesses in response to the loss of a spouse than do widows. It has been argued that women's biopsychosocial adaptation to stress, in contrast to that of men, is to seek out relaxation and affiliation. Women's stress reactions include nurturance to protect the self and offspring and reduce distress, and the creation of social networks that facilitate nurturance. These reactions might reduce vulnerability to stress-related illnesses.

Ethnicity may be relevant to caregiver health because it is related to health disparities and ethnic groups respond differently to caregiving. Also, African American caregivers may have fewer economic resources than Caucasian caregivers, but they may have more spiritual resources. Caregiving occurs in the context of cultural meaning, and might be perceived as having different rewards or challenges by member of different ethnic groups.

A history of depression constitutes a further vulnerability, in that 73% of caregivers with such a history had a recurrence of depression while they were caregivers, but only 30% of noncaregivers had a recurrence during a similar time frame. This is important because depression is positively related to health problems in caregivers and in the general population. Anger and

hostility are also relevant to caregiver health because anger is a risk factor for elevated blood pressure and greater body mass index, fat and caloric intake, and glucose and insulin levels. Indeed, caregivers have elevated levels of anger, and caregivers who are critical of their spouses report more trait anger than those who are not critical of their spouses. Moreover, caregivers high in anger have higher levels of fasting glucose than do controls high in anger, but no differences exist in caregivers and controls that are low in anger. Finally, comorbidities such as a history of cancer, hypertension, and coronary disease may moderate relationships between caregiving and physiological measures that are associated with these diseases.

In one analysis, caregivers with cancer histories had lower natural killer cell activity than did noncaregivers with cancer histories, but no differences existed in caregivers and noncaregivers without cancer histories. In another analysis, no effect was observed on systolic blood pressure reactivity for caregivers and noncaregivers with normal blood pressure, but hypertensive caregivers showed greater reactivity than did hypertensive noncaregivers. Also, caregivers with coronary disease had higher levels on the metabolic syndrome, a linear combination of fasting glucose, insulin, lipids, mean arterial pressure, and obesity, than did noncaregivers with coronary disease; however, no difference occurred for caregivers and noncaregivers free of such disease.

In contrast to vulnerabilities, resources such as emotional and instrumental supports are related to better health habits, less distress, and lower prevalence of coronary heart disease (CHD). High levels of perceived support also predict better-reported health in caregivers. High socioeconomic status (SES) is associated with better physical health and lower CHD prevalence, and low SES is related to poorer health in caregivers. Active coping, such as problem solving, is inversely associated with elevated distress, poor health habits, and physiological risk. Other positive factors, which involve the rewards of caregiving, have also been documented. These include a sense of meaning, meeting interpersonal obligations, pleasure in providing care to a loved one, and satisfaction. Unfortunately, the positive aspects of caregiving have not received enough attention.

## CONCLUSIONS

Family caregivers are critical to the health and support of persons with AD. It is, therefore, important that

we understand, and potentially modify, relationships between their exposure to the chronic stress of caregiving and the subsequent development of psychological or physical health problems. Caregivers with preexisting comorbidities may be at particular risk. General research on stress and illness suggests that persons with comorbidities may be at higher risk for health problems in response to stress than persons free of such morbidities. Importantly, the population of older caregivers with comorbidities is large, yet they have been largely ignored in this literature as have other subgroups defined by individual difference variables. Research incorporating assessments of individual differences and other health indicators will facilitate targeting high-risk caregivers and could be used to develop cost-effective treatments for those who can profit most from interventions. By helping caregivers to maintain their health, such interventions should also help care recipients and society.

—Peter P. Vitaliano and Heather Young

See also CAREGIVING AND STRESS; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH

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## ANGER AND HEART DISEASE

The concept of anger as a risk factor for cardiovascular disease originated from the idea that certain behavior patterns were found more commonly among cardiac patients. At the end of the 19th century, Sir William Osler (1892), considered the father of modern medicine, noticed certain characteristics of patients with heart disease:

In the worry and strain of modern life, arterial degeneration is not only very common but develops at a relatively early age. For this, I believe that the high pressure at which men live, and the habit of working the machine to its maximum capacity are responsible [for coronary disease].

In the mid-20th century, the Type A "coronary-prone behavior" was defined by Friedman and Rosenman (1959/1974). Typical characteristics of the Type A behavior included competitiveness, excessive drive or achievement-striving, enhanced sense of time urgency, enhanced aggressiveness, ambitiousness, intense concentration and alertness, and high levels of "free-floating hostility." In 1978, this stereotype later became known as the Framingham Type A behavior. Additional descriptors for this type included pressed for time, preoccupied with work, stretched by work, uncertain/dissatisfied about your performance, eating too quickly, strong need to excel, upset when waiting, hard-driving and competitive, bossy or dominating.

However, there were conflicting studies for and against the "Type A hypothesis" as a true risk factor for heart disease. With further investigation, the

anger-hostility complex was identified as the "toxic element." According to the Structured Interview personality test, people with this complex had the potential for hostility, anger directed outward, competitiveness, anger experience, vigorous answers, irritation at waiting in lines, and explosive voice modulations. A special hostility scale was developed by Cook and Medley in 1954 as part of the Minnesota Multiphasic Personality Inventory, and included traits such as cynicism, angry feelings, and aggressive responding to provocation. Investigations over the past couple decades have focused on anger-hostility as the potentially important risk factor for heart disease.

## EPIDEMIOLOGICAL EVIDENCE

Commonly recognized components of anger include anger-out (expression, nonneurotic hostility), anger-in (suppression, neurotic hostility), and anger experience. Although studies have shown mixed results, anger-in, or the suppression of anger, competes with anger-out, or the full-blown expression of anger, as the main predictor for coronary artery disease risk. The Cook-Medley Hostility (Ho) Scale has been the most frequently used quantitative measure for anger and hostility, and high Ho scores have been related to cardiovascular disease in many studies. Other frequently used measurement tools for anger and hostility include the Spielberger Multidimensional Anger Inventory, the Framingham Anger Scale, Hostility scales of the Buss-Durkee Inventory, and subscales of various other personality tests.

Cross-sectional studies have shown that episodes of anger may "trigger" heart attacks. In the ONSET study, the risk of myocardial infarction was found to be elevated only during the first 2 hours after an outburst of anger. Several studies have demonstrated an ill effect of mental stress or anger on cardiovascular physiologic responses, such as increased blood pressure and heart rates, lower heart function, and coronary vasoconstriction.

Many prospective cohort studies have shown that anger or hostility leads to an increased risk of developing subsequent cardiovascular disease, particularly coronary heart disease, hypertension, and stroke. This relationship has been seen in the Framingham Heart Study, the Western Collaborative Group Study, Normative Aging Study, Finnish men, Danish men and women, the Caerphilly Study, the Atherosclerosis Risk in Communities (ARIC) Study, the Johns



Hopkins Precursors Study, and various student populations. This risk may be conferred in a dose-response manner. A recent report suggested that anger experienced in younger populations may increase risk for premature heart disease.

Studies to date assume that anger is a trait that remains constant over time and affects heart disease incidence uniformly throughout follow-up. However, human behavior can change over time, and so may a person's experience or expression of anger. Most studies have only been able to assess anger at limited time points, and more investigation is warranted to evaluate the more chronic effect of this potentially manageable emotion.

### POSSIBLE BIOLOGICAL MECHANISMS

Although the exact mechanism by which anger may cause cardiovascular disease remains unclear, anger may have a role in underlying atherogenesis as well as triggering clinical events. Anger increases cardiovascular reactivity as manifested by increased catecholamine levels, heart rates, and blood pressure. In recent studies, high levels of anger during anger recall have produced vasoconstriction of narrowed coronary arteries, but not of nonnarrowed arteries, suggesting that patients with preexisting disease may have blood vessels that are more reactive to anger. In patients with stable coronary artery disease, anger recall has reduced heart function (left ventricular ejection fraction and cardiac output) and increased various pressures (diastolic blood pressure and peripheral vascular resistance), more than exercise or other psychological stressors. Furthermore, anger may increase vulnerability to ventricular arrhythmias, which can lead to sudden death. Angry people have also shown increased platelet reactivity and hyperaggregability, and platelets are the blood cells typically implicated in causing heart attacks. Chronically, anger may influence risk through established cardiac risk factors, such as hypertension or depression.

### IMPLICATIONS FOR ANGER MANAGEMENT

Since the mid-1970s, various stress management techniques have been used as part of therapeutic behavioral programs to treat anger and hostility, and, in the earlier years, the Type A behavior pattern. In current practice, formal cardiac rehabilitation and exercise training programs have been shown to improve exercise capacity, plasma cholesterol levels, obesity, major morbidity, and mortality, and can reduce hostility or

angry behavior. Community studies in older populations have observed that secondary prevention efforts to reduce stress and anger have led to decreased incidence of recurrent ischemic events. Whether knowledge about anger can be translated into effective primary prevention strategies needs to be determined.

—Patricia P. Chang

See also ANGER AND HYPERTENSION; ANGER: MEASUREMENT

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## ANGER AND HYPERTENSION

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The causes of chronically elevated blood pressure, formally known as hypertension (HT), are not well

understood by medical scientists and practitioners although there has been a long-standing belief that mental or emotional factors may be involved. During the 1930s-1950s, psychoanalytically oriented practitioners and researchers, representing the psychosomatic movement, emphasized that mental and emotional distress can contribute to the development of physical disorders. Two leaders of the psychosomatic movement, Flanders Dunbar and Franz Alexander, proposed that inhibition of angry feelings contributes to the development of HT. They reasoned that hostile provocation typically is associated with increases in blood pressure (BP), but after the anger is expressed, BP typically decreases. However, according to the anger-suppression hypothesis, some persons are personally predisposed to suppress their rage. This leads to recurrent autonomic arousal, which eventually leads to chronically elevated BP. According to this idea, the habitual tendency to suppress angry feelings was conceptualized as a personality trait that represented a fear or anxiety about expressing anger to others. Alexander also thought that some constitutional physical predisposition and a stressful, precipitating condition, such as a serious interpersonal conflict or death of a close relative, were also necessary conditions for the development of HT, but these qualifiers have not tended to receive attention from subsequent researchers.

From its inception, the idea of a “hypertensive personality” was controversial among physicians who were skeptical about a role for emotional and mental factors in the development of HT. Although the psychoanalytic approach waned in influence, interest in this topic reemerged with the rise of behavioral medicine and health psychology. In the past three decades, nearly 50 studies testing the anger expression hypothesis have been published.

### CROSS-SECTIONAL EVIDENCE

Most studies testing this idea have been cross-sectional in design. In such studies, HTs were identified at medical clinics as a result of self-referral and constituted the “cases” whose responses on the anger scales are compared with responses of nonpatients unconnected to the medical clinic. Other studies also have been cross-sectional but sampled from larger populations and identified HTs through community screening.

Studies have used a variety of self-report measures to assess the individual’s habitual tendency to express

anger, but only a few scales have adequate validation. Charles Spielberger and Ernest Harburg developed the most popular instruments to measure personal tendencies to express (*anger-out*) and suppress (*anger-in*) anger. A general problem in this literature, however, is that there is little consensus about the best way to measure anger expression because anger is a multidimensional and thus potentially ambiguous construct. In addition, although these scales purport to assess personal reluctance to express annoyance and irritation, they also are strongly saturated with more general negative feelings. Consequently, it may not be anger-in per se that is responsible when positive results are obtained.

Narrative and quantitative reviews of the empirical literature indicate that several studies report positive associations, typically of modest to moderate strength, between anger suppression and BP, consistent with the psychosomatic hypothesis. However, the results across studies are highly variable. One recent study employing an extensive series of psychological measures, including anger expression, and assessing BP in the clinic and using an ambulatory BP monitor for 24 hours during a normal workday failed to find any significant associations between personality and BP.

### ALTERNATIVE EXPLANATIONS

Some of the positive findings have been criticized on the basis of possible participant selection bias. The reasoning is that hypertensive persons may only appear to be higher in anger-in. Psychological inventories measuring anger also tend to load heavily on neuroticism. Neurotic individuals are known to be somatically concerned, worry about their health, and are more likely to refer themselves for medical attention. Such frequent medical consultation increases the chances of detecting HT, a relatively common physical disorder. The sampling bias explanation implies that an association between anger and HT should not appear in randomly selected samples where angry-neurotic individuals should not be overrepresented. A meta-analysis assessed this possibility, but still found positive associations between anger and HT in population samples, hence reducing the likelihood of subject selection as an alternative explanation for positive results linking anger-in and BP.

It also has been speculated that the positive results may represent a “white coat effect” (i.e., when some persons show elevated BP in the clinic but normal pressures during everyday life—presumably because

they become anxious during medical examinations). Because angry persons might be prone to show greater BP responses to clinic assessment, their pressures may erroneously be interpreted as an indication of chronically elevated BP. However, a review of the results for white coaters versus non-white coaters actually showed that persons with higher pressures in the clinic but lower pressures during daily life had lower anger scores. An alternative explanation that has not been ruled out by cross-sectional studies is that being diagnosed and labeled a hypertensive person might affect personality.

### PROSPECTIVE EVIDENCE

Prospective studies that adjust for baseline BP and traditional HT risk factors should provide more rigorous scientific tests of the anger suppression hypothesis although only a small number of such studies currently are available. Most of the available studies report mixed support, at best, for the anger expression hypothesis. Moreover, some of the studies reporting supportive evidence suffer from the failure to use standardized measures of anger or to control for baseline BP, potentially serious limitations. One of the best studies found that the tendency to express anger in either direction (anger-in and anger-out) was related to subsequent HT. In the context of these disparate results for anger expression, it is interesting that five prospective studies show consistent evidence of an association between symptoms of anxiety and depression and subsequent HT. Because several anger expression measures overlap with anxious and depressed feelings, it remains a possibility that this overlap is responsible for the positive findings that have been interpreted as support for the anger expression hypothesis.

In summary, evidence for the anger suppression-HT hypothesis is inconsistent and subject to alternative interpretations. A definitive answer is unlikely to be available until several more prospective studies are available that employ standardized measures of anger expression and adjust for other negative emotions.

—Jerry Suls

See also ANGER AND HEART DISEASE; ANGER: MEASUREMENT

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## ANGER: MEASUREMENT

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A linkage of emotional factors to psychological and physical health was posited in the pre-Cartesian writings of philosophers and physicians. With theoretical and methodological advances in physiology, psychology, medicine, and sociology, prescientific speculations evolved to a rigorous examination of the scientific basis of the role of the experience, management, and expression of emotion in the etiology and pathophysiology of disease. Although inconsistent findings are reported, a body of evidence is consistent with the notion that the connection between stressors and disease can be mediated by such psychosocial factors as hostility, and the experience and expression of anger.

Because of the major impact of cardiovascular disorders on morbidity and mortality and the fact that traditional risk factors (e.g., cholesterol, smoking, obesity) cannot account for all incidences of these diseases, a large body of empirical evidence has accumulated across decades attempting to link anger and hostility to the development of heart disease and high blood pressure. Moreover, empirical analyses (viz., meta-analyses) of this literature have shed light on issues pertaining to the study of anger, hostility, and health status. Thus, as a means of elucidating measurement and conceptual issues related to investigating linkages of health status with anger and hostility, this entry focuses on an examination of the empirical literature correlating diseases of the cardiovascular system with hostility and anger experience and expression.

## DIMENSIONS OF ANGER AND HOSTILITY

Typically, hostility is defined as a cognitive set characterized by a cynical mistrust and suspiciousness of others. Within the interpersonal context, this cognitive set is thought to increase the likelihood of the experience of angry affect, including resentment, disgust, irritability, and contempt, and the subsequent behavioral expression of aggression (e.g., verbal attack, physical assault, and indirect actions such as gossip and character assassination). Anger expression has been further divided into (a) anger-out (use of overt behavior that can be viewed by others), (b) anger-in (the suppression of the overt expression of anger), and (c) constructive anger expression (an assertive and mature discussion of the interpersonal triggers of the anger). Jorgensen and colleagues created another set of distinctions; namely, anger assessments were divided into (a) interpersonal analogue assessment for measures associated with an interpersonal context (e.g., role-playing, projective tests administered by another person, use of interpersonal vignettes, and interviews), (b) reported overt reactions (e.g., self-report of anger-out, assertion, or dominance strivings), (c) covert anger reactions (e.g., anger-in and trait anger), and (d) ambiguous (a combination of reported overt reactions and covert reactions). These distinctions have proven useful in understanding the nature of anger/hostility measurement in the study of disease outcomes.

### Nature of the Association

Meta-analytic work on research correlating anger and hostility measures with heart disease outcomes shows, in general, weak associations and substantial variation between studies. Moreover, associations have been shown to vary as a function of demographics (e.g., ethnicity, age, socioeconomic status [SES]), health status (e.g., awareness vs. unawareness of high blood pressure or studying individuals with coronary heart disease [CHD] or at high risk for CHD), and type of assessment procedure.

### Categories of Covert Anger Reactions and Ambiguous

Measures of covert anger and hostility and the ambiguous category show very weak, positive associations with CHD and high blood pressure (a risk factor for CHD). A number of reasons may contribute

to these results. First, these measures (e.g., the Cook-Medley Hostility Scale [Ho]; Anger-In and Trait Anger Scales of Spielberger and colleagues) do not provide a unitary, summed score centering on a specific context. Given the importance of the interpersonal context in hostility and anger, it is possible that overall scores for covert anger and hostility do not adequately tap salient interpersonal dimensions when items basically capture a generalized affective experience. Second, respondents are asked to report on socially undesirable attributes. Thus, people may either knowingly (impression management) or unknowingly (defensive, self-deception) underreport the experience of covert anger and hostile cognition. These measures typically correlate positively with measures of social defensiveness (e.g., Marlowe-Crowne Social Desirability Scale).

Measures of covert anger also have been shown to correlate with measures of neuroticism/negative affectivity, which have been reported to (a) not correlate with heart disease, (b) be inversely related to blood pressure (BP) elevations for persons unaware of their BP status but directly related in persons aware of their BP status, and (c) correlate with angina symptoms in persons without CHD. Depending on sample composition (e.g., inadvertent selection of a high proportion of persons with high neuroticism score) scores of experiential, covert anger may be elevated due to the neuroticism factor, which may obscure associations by itself or in combination with other dimensions (e.g., BP status awareness or persons with symptoms of angina without underlying disease). Likewise, assuming that equal scores derived from summing across items represent persons of equivalent dispositional covert anger may not be tenable. For example, two people may show the same score on the Ho, but one person's score may be largely due to attributing hostile intentions to the behavior of others, whereas the other's score may be largely due to a self-description related to the affective and behavioral manifestations of hostility. Finally, these self-report measures may not provide response options germane to many respondents; that is, items may not be relevant to a respondent's way of construing her or his covert anger, which is likely to be influenced by such factors as SES, ethnicity, family background, and age.

### Overt Reactions

Although sharing the above problems with covert anger, evidence exists suggesting that reported overt

reactions also show weak associations with CHD and elevated BP. For example, it has been reported that a neurotic hostility factor (such covert reactions as irritability, resentment, mistrust, and suspicion) was unrelated to angiographically determined coronary artery disease (CAD), whereas the expression of anger/hostility (e.g., verbal or physical attacks) was correlated positively with CAD; these two dimensions were factor analytically derived from the Buss-Durkee Hostility Inventory. Regarding high BP, reported overt reactions have been shown to correlate negatively with BP levels, an association that appears augmented by age (tends to be stronger for older participants) and ethnicity (tends to be stronger for Black people relative to White people).

### Interpersonal Analogue Assessment

For both CHD and high BP, interpersonal analogue assessments show the strongest effect sizes. Interview (e.g., the Structured Interview for coronary-prone behavior) and role-playing (e.g., acting out a scenario requiring assertion of personal rights with another person) methods present potential advantages over self-report measures. First, respondents are less constrained in the range and richness of their responses to open-ended questions. Second, there can be a minimization of response error related to such factors as faulty recall, misunderstanding of items due to educational or cultural factors, or difficulty with conceptualizing the occurrence and/or intensity of ambiguous internal affective or mental states. Third, response bias related to impression management and self-deception may be decreased due to a focus on trained judges scoring behavior unbeknownst to the respondent.

All of these potential advantages require (a) highly trained and skilled interviewers or actors capable of rapport building and adjusting to the fluidity of the interpersonal transaction, and (b) highly skilled judges trained in a reliable and valid coding system. Both judges and interviewers must have a keen awareness of how demographics of the sample influence construal of and responses to interpersonal contexts.

Disadvantages relate to the labor-intensive work of finding and training conscientious and perspicacious personnel, the consistent execution of the interpersonal transaction, and potential problems with the drift of reliability across the course of the investigation. Although the focus is on coding behaviors unbeknownst to the respondent, interviews and role-playing may still be vulnerable to factors of impression

management and self-deception since social norms impose prohibitions against the improper and excessive expression of anger and hostility in most social settings, including the research context. Again, raters of the behavior must have a keen eye for the subtleties and nuances of how hostility and anger are expressed.

Use of interpersonal vignettes (e.g., those created by Harburg and colleagues) to prime responding may aid self-description of angry reactions due to the use of specific interpersonal contexts that can be conceptualized and reacted to with minimal contextual ambiguity. Like self-report measures, vignettes are convenient. However, like self-report measures, the vignette approach may be more vulnerable to social defensiveness skewing responses in a socially desirable direction.

### SUMMARY AND ALTERNATIVE CONCEPTUAL FRAMEWORK

By using cardiovascular disorders as exemplars, this entry has shown that any attempt at linking traits of hostility and anger will confront a number of challenges. These include issues related to psychometrics (e.g., a single summary score may reflect more than one dimension, despite adequate markers of reliability and validity), severity and knowledge of disease, demographics, whether respondents can understand and accurately respond to item content, type of measurement procedure, and the degree to which the measurement procedure embodies the anger-inducing context, which is interpersonal in many cases. Even though interpersonal analogue assessments hold promise of reducing a number of measurement challenges, queries and scenarios must be finely crafted to the anger-inducing context. For example, if the conceptual question relates to angry protests following diagnosis of a fatal disease, it may make little sense to query about irritation induced by a driver slowing down traffic; rather, questions concerning potential resentment over abandonment by God, friends, and family may be more on the mark.

To date, a trait emphasis has been deployed in researching relations between health and agonistic reactions. This emphasis assumes consistency of cognition, behavior, and affect across time and situations, and stresses increasing reliability by averaging or summing (i.e., aggregation) across occasions of measurement. Aggregation, in essence, considers variation across occasions as error rather than a source of information on personality.

An alternative perspective is to consider variation across situations as a coherent marker of personality functioning. In other words, by studying person and environmental factors associated with the variability of state anger occasions, a more comprehensive picture of anger expression, anger experience, and hostile attitudes in relation to interpersonal conflict may emerge and, thereby, increase the precision of predicting disease outcomes. Recall that in the prediction of cardiovascular disorders, effect sizes were best for assessment procedures grounded in an interpersonal context; nevertheless, the effects were of a modest magnitude. With current technologies, hand-held computers can be used to assess occurrence and intensity of angry reactions as BP and heart rate (HR) are measured, for example, across a workday. Variation in outcomes involving both ecological and lab assessments are likely to occur. For example, an initially healthy person who eventually develops CHD may manifest high hostility during a structured interview in the lab (SI) and then, across the workday, show a pattern of high levels of BP and HR with coextensive frequent and intense bouts of anger and anger expression, particularly in the interpersonal context. Conversely, an initially healthy person, who displays elevated ambulatory BP at work and eventually develops high BP, may show low SI hostility and then display frequent and intense bouts of anger without anger expression while at work. By reporting high levels of SI-induced anger, the former individual shows more consistency with the ecological anger reports, whereas the latter person, due to social acceptance strivings triggered within the lab context, reports low levels of state anger that are inconsistent with anger experienced at work. As suggested in this brief example, patterns of both consistency and variation hold the promise of shedding light on the complex challenge of linking anger and hostility measurement with health status.

—Randall S. Jorgensen

See also ANGER AND HEART DISEASE; ANGER AND HYPERTENSION

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## ANOREXIA NERVOSA. See EATING DISORDER

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## ANXIETY, HEART DISEASE, AND MORTALITY

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Although many experts consider anxiety to be a universal feature of human existence, when it is chronic and persistent it may have significant consequences for both psychological and physical health. A relationship between anxiety and heart disease has been long noted by physicians. Coronary heart disease (CHD) accounts for approximately 2.2 million hospitalizations annually in the United States. The traditional risk factors (e.g., smoking, hypertension) explain only about 40% of the occurrence of CHD. There is converging evidence that chronic anxiety, in addition to causing emotional distress, strongly affects heart health. In fact, some scientists have suggested that anxiety may even influence longevity, whereby more anxious people die sooner. If anxiety indeed puts people at greater risk for heart disease or premature mortality, it is critically important that society invests in the identification and treatment of individuals affected with anxiety. This could not only ease a great deal of distress but also represent a potentially important route to disease prevention.

### THE NATURE OF ANXIETY

Anxiety is a strong negative emotion, accompanied by a sense of unease, worry, and intrusive thoughts that cannot be put to rest. Anxiety disorders are among the most prevalent psychiatric disorders in the United States. Recent surveys estimate the prevalence of anxiety in the general U.S. population ranging from 12.6% to 17.2%. Psychologists have suggested that

clinical and subclinical anxiety are not clearly separable phenomena. As a result, prevalence estimates may be conservative because they fail to include individuals who experience high anxiety levels but who do not meet diagnostic criteria for an anxiety disorder.

A characterization of anxiety can be informed by an understanding of the nature of emotions more generally. Theorists generally agree that specific emotions arise out of the interaction between individuals and their environments, and motivate individuals to respond to external events (Frijda, 1986). For example, if one is crossing a street and sees a car approaching quickly, one might feel fear. The fear might then motivate the individual to run out of the way. Although emotions are generally adaptive processes, they can have adverse consequences when the system is taxed beyond the limits of its capability. For example, when individuals are getting ready to take an exam, they might feel anxious about their performance. This anxiety can motivate them to prepare appropriately for the exam. However, if they feel they cannot ever be prepared or cannot cope with their anxiety, the emotion may no longer be adaptive. In such cases, the anxiety may itself become a problem. A variety of theories have been proposed to explain the development of anxiety and its disorders (Amir & Kozak, 1998).

Because the word *anxiety* represents both a lay construct and a scientific term, precise definitions are needed to facilitate research on the topic. Anxiety is a future-oriented negative emotional state that results from perceptions of threat. It is characterized by a sense that one is unable to predict, control, or obtain desired results in upcoming situations (Barlow, 1988). Most people experience some level of anxiety at different points in their lives. Anxiety may be considered as a *state*, an episodic experience of the emotion brought on by specific situations. Or it may be considered as a *trait*, an enduring temperament, or predisposition to experience the state of anxiety frequently. Thus, someone who is characterized as “anxious” may be a person who frequently experiences states of anxiety in response to many different situations.

Because everyone experiences anxiety from time to time, it is useful to distinguish normal from pathological anxiety. Generally, when anxiety occurs repeatedly at high levels, persists when real threats are minimal, and interferes with routine functioning, it may be considered a clinical or pathological manifestation. A number of clinically defined disorders are

subsumed under the heading of anxiety disorders, for example, panic disorder, social and simple phobias, generalized anxiety disorder, and posttraumatic stress disorder. Psychological research has suggested that pathological and normal anxiety reactions are essentially similar, and differ not in terms of what it means to feel anxious, but in the duration, intensity, and timing of the experience.

## STUDIES OF ANXIETY AND THE HEART

The body’s physiological response mechanisms are well adapted for dealing with short-term physical emergencies such as running from danger. But anxiety and other emotions may activate these same physiological responses in the absence of actual danger. If such responses are turned on frequently, or are not shut off appropriately, they can become damaging. Thus, anxiety may influence heart health directly because it evokes physiological processes (e.g., excessive release of hormones, increased speed of heart rate), and indirectly because it influences health-related behaviors.

Studies have examined the relationship between anxiety and CHD or mortality in a number of different ways. Causality between emotion and health may go in both directions—chronic anxiety may set disease processes in motion, but feeling sick may also make people anxious. Moreover, if chronic anxiety is going to influence health, it will be a function of cumulative effects over time. It is not feasible to conduct true experiments in which people can be assigned to experience anxiety or not on an ongoing basis. As a result, prospective studies are best suited for investigating the risk of disease or death associated with chronic anxiety. These studies measure anxiety among initially disease-free individuals, and follow them over time to see who develops heart disease or dies. This allows investigators to be sure that illness is not causing anxiety.

## Anxiety and Coronary Heart Disease

### *Development*

Most prospective epidemiological studies have found an association between self-reported symptoms of anxiety and risk of developing CHD. In one of the earliest cohort studies, the Northwick Park Heart Study, 1,457 initially healthy men were followed for 10 years (Haines, Imeson, & Meade, 1987).

This study found a significant association between self-reported symptoms of phobic anxiety and fatal CHD. Compared with men reporting low anxiety levels, more anxious men were at almost 4 times the risk of fatal CHD (relative risk = 3.77, 95% confidence interval 1.64 to 8.64). These associations were present after taking account of other coronary risk factors (such as family history of heart disease). Other studies have found similar results using a variety of different measures of anxiety, with anxious individuals at 2.5 to 6 times the risk of CHD compared with less anxious individuals. In most studies, investigators have found a “dose-response” effect such that increases in anxiety were associated with increases in risk of CHD. A strength of these studies is that they all tried to control for numerous confounding factors, such as family history of heart disease or smoking. The magnitude, consistency, and dose-response gradient of the association lend support to the notion that anxiety may contribute to risk of CHD. Nonetheless, more work is needed to examine and confirm the nature of this association.

A small number of studies have not found evidence of anxiety as a risk factor for CHD, although generally the design of these studies was not as strong as the studies with positive findings (Kubzansky, Kawachi, Weiss, & Sparrow, 1998). Some investigators have speculated that the apparent excess risk of CHD among anxiety disorder patients may be due to a drug effect, since many of these patients use psychotropic medication. Little research has been done that directly addresses this question. However, one study of fatal heart attack in women examined the use of antianxiety medication, and found that the excess risk of coronary death was unlikely to be due to the effect of a drug. Rather, this study found that the excess risk of CHD death was related to the underlying condition that led to the original prescription of psychotropic drugs, rather than to the drugs themselves (Thorogood, Cowen, Mann, Murphy, & Vessey, 1992). The possibility that subclinical heart disease may lead to the subjective experience of anxiety cannot be excluded. However, no data presently exist demonstrating a relationship between subclinical CHD and anxiety. In the absence of symptoms, it is difficult to argue that knowledge of potential disease status, or physical discomfort associated with subclinical disease, caused anxiety. In fact, it has been found that individuals reporting symptoms of CHD often have normal or near normal arteries, suggesting that these individuals have primary psychiatric rather than cardiac disorders.

### *Prognosis*

Although researchers have more often studied effects of depression rather than anxiety in coronary patients, a number of studies have found that anxiety is also very common among individuals with established heart disease. Approximately 50% of patients in the coronary care unit exhibit very high levels of anxiety. Unfortunately, in the vast majority of these patients, the anxiety is neither diagnosed nor treated. Studies have suggested that the increased risk of further complications in highly anxious patients with heart disease may range from 2.5- to 5-fold (Moser & Dracup, 1996). As yet, the mechanisms for these effects are not well understood. However, given that anxiety activates a variety of physiological and behavioral responses known to influence heart health, it may affect not only the development of CHD but also outcomes following acute coronary events.

### *Anxiety and Mortality*

Researchers have also studied the association between anxiety and mortality. The majority of published studies have found that there is indeed a relationship between anxiety and mortality—generally, these studies have been methodologically stronger than those that did not find such a relationship. In many of these studies, the cause of death was related to CHD. For example, studies of psychiatric patients have suggested a link between anxiety disorders and premature death from CHD. However, a number of studies have also suggested that anxiety is associated with other causes of death. For example, two recent studies found that among breast cancer patients, those with higher levels of anxiety did not survive as long (Gibrar, 1996; Weihs, Enright, Simmens, & Reiss, 2000). Other studies have found increased risk of premature mortality from all causes of death for highly anxious individuals relative to those who are less anxious. Some of this work has found that men (but not women) with anxiety disorders are at increased risk for premature mortality. However, a systematic comparison of risk for men and women has not yet been done.

### *Potential Mechanisms: Physical Effects of Anxiety*

Several mechanisms have been proposed by which chronic anxiety may result in damage to the heart and subsequent increased risk of CHD. Anxiety may affect



the heart indirectly by influencing a variety of behaviors that can damage the heart over time, including loss of sleep, decreased physical activity, poor diet, and increased smoking, alcohol consumption, and drug use. A variety of research has found that anxious individuals are less likely to engage in health-promoting behaviors (Kubzansky et al., 1998). Anxiety may also trigger cognitive or social processes that, in turn, affect health. For example, anxious individuals may be less likely to have effective problem-solving skills. Thus, they may experience higher levels of stress in response to a variety of situations relative to their less anxious peers.

Chronic anxiety may also cause damage to the heart more directly by repeatedly activating the sympathetic nervous system, causing excess release of hormones, and suppressing immune function (Schneiderman, 1987). This may lead to a cascade of effects beginning with physical and chemical changes in the blood and blood flow that ultimately damage the heart. For example, the recurring release of certain hormones may cause a buildup of fatty deposits in the coronary arteries. This can lead to atherosclerosis—damage in the coronary arteries resulting in narrowing and eventual impairment of blood flow. One recent study found that atherosclerosis developed at a faster rate among individuals reporting high versus low levels of anxiety (Paterniti, Zureik, Ducimetiere, Fève, & Alperovitch, 2001).

Anxiety may also influence the electrical stability of the heart in a variety of ways. Recurrent anxiety may disrupt the balance between the sympathetic and parasympathetic nervous systems that together regulate cardiac rhythm. Heart rate variability (HRV) provides a noninvasive measure of this balance. A variety of studies provide converging evidence of an association between anxiety and altered HRV. In some studies, decreased HRV has been associated with social inhibition in children, itself a developmental precursor of panic and other anxiety disorders. Multiple studies have also revealed an association between anxiety and altered HRV among adults. Taken together, these findings suggest that abnormal regulation of cardiac rhythm, as measured by reduced HRV, may be an important mechanism linking anxiety and CHD, especially sudden cardiac death.

Anxiety may also place people at greater risk for CHD by leading to alterations in blood pressure and heart rate. Generally, the research suggests that a stable anxious disposition is related to an increased risk

of high blood pressure (hypertension). Studies in psychiatric and nonclinical settings largely support the notion that highly anxious individuals are more likely to develop hypertension. For example, one study of 468 middle-aged normotensive women found that those with more anxiety had greater increases in systolic blood pressure over a 3-year period (Markovitz, Matthews, Wing, Kuller, & Meilahn, 1991). Effects of anxiety on blood pressure may be even greater than research has found to date. Some investigators have found that there is a subset of anxious individuals who repress their anxiety, and as a result are not identified as being anxious by the usual measures. However, research designed to identify these people has often found that repressed anxiety is also associated with increased risk for hypertension.

#### *Acute Anxiety and Triggering of CHD*

There is some evidence that anxiety might have immediate effects and actually trigger a heart attack. Triggering mechanisms may differ from those that incur long-term damage. For example, the sharp hemodynamic changes associated with acute anxiety states may precipitate plaque rupture in predisposed coronary vessels. For example, one study found that risk for heart attack was approximately 1.5 times increased when an anxiety episode occurred in the 2 hours preceding the event (Mittleman et al., 1995). Thus, anxiety may influence CHD and mortality via both chronic and acute effects.

—Laura D. Kubzansky and Carlotta M. Arthur

See also ANXIETY: ITS MEANING AND MEASUREMENT; HEART DISEASE AND DIET; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND REACTIVITY; HEART DISEASE AND SMOKING; HEART DISEASE AND TYPE A BEHAVIOR

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## ANXIETY: ITS MEANING AND MEASUREMENT

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Anxiety emerged as a central problem and a predominant theme of modern life in the 20th century, which the French author Albert Camus referred to as "the century of fear" (May, 1950/1977). The *Age of*

*Anxiety* was the title of both Leonard Bernstein's Second Symphony and a poetic work by W. H. Auden (May, 1950/1977). Inspired by Bernstein's music and Auden's poem, Jerome Robbins choreographed a contemporary ballet, which he also titled the *Age of Anxiety* (Mason, 1954). The significant impact of anxiety in literature, music, art, and religion, as well as in psychoanalysis, psychiatry, and psychology, was cogently described by Rollo May (1950/1977) in his classic book, *The Meaning of Anxiety*. May also documents concern with anxiety in the philosophical work of Pascal, Nietzsche, Schopenhauer, and, especially, Kierkegaard and Spinoza, who considered fear to be a state of mind characterized by the expectation that something painful or unpleasant might happen.

Although the pervasive influence of anxiety on human behavior was not generally recognized until the 20th century, concerns with fear are as old as the history of humankind. The concept of fear was clearly represented in ancient Egyptian hieroglyphics, the Old Testament, and in Greek and Roman literature (May, 1950/1977). The importance of fear was clearly recognized by Charles Darwin (1872/1965), who considered this emotion to be an inherent characteristic that had evolved in both humans and animals as an adaptive response over countless generations. Observable manifestations of fear included: rapid palpitations of the heart, trembling, increased perspiration, changes in voice quality, erection of the hair, and peculiar facial expression. Consistent with contemporary definitions of anxiety, Darwin observed that fear varied in intensity, from mild apprehension or surprise, to an extreme "agony of terror."

The physiological manifestations that Darwin attributed to fear were also recognized as symptoms of anxiety by Sigmund Freud (1933/1959, 1936). However, Freud emphasized the experiential qualities of anxiety, which he defined as "something felt," an unpleasant emotional state characterized by subjective feelings of chronic apprehension, and by "all that is covered by the word 'nervousness'" (1895/1924, p. 79). The perceived presence of danger, according to Freud, evoked an anxiety state that served to warn the individual that some form of adjustment was necessary. Stimulated by psychoanalytic theory, clinical studies of anxiety have been reported in the psychiatric literature with increasing regularity. Pavlov's (1927) discovery of experimental neurosis also stimulated numerous investigations of fear and anxiety in animals. However, prior to 1950, there were relatively

few experimental studies of anxiety in humans. Ethical problems associated with inducing anxiety in the laboratory contributed to this paucity of research, which could not advance beyond a prescientific level until objective and reliable measures of anxiety were available.

The Taylor (1951, 1953) Manifest Anxiety Scale (TMAS) was the first of a number of widely used psychometric instruments designed to assess anxiety in adults. The rationale for constructing the TMAS, which has been used extensively in research on motivation and learning (Spence & Spence, 1966), was based on the assumption that anxious people are chronically more emotional and consistently higher in motivation or drive level than persons low in anxiety. The 50 TMAS items were selected from the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1942, 1951) on the basis of a textbook description of the symptoms observed in patients with anxiety neurosis (Cameron, 1947), a clinical syndrome first identified by Freud (1895/1924). Respondents to the TMAS report whether or not each item describes how they generally feel.

The TMAS, Cattell's (1957) Anxiety Scale Questionnaire (ASQ; Cattell & Scheier, 1963), the Affect Adjective Check List (AACL; Zuckerman, 1960; Zuckerman & Lubin, 1965), and the State-Trait Anxiety Inventory (STAI; Spielberger, 1983; Spielberger, Gorsuch, & Lushene, 1970) are the psychometric instruments that have been most frequently used to assess anxiety in research and clinical practice over the past 50 years. Cattell and his colleagues (Cattell, 1966; Cattell & Scheier, 1958, 1963) pioneered the use of multivariate techniques in the assessment of anxiety, and identified trait and state anxiety as unique constructs. As currently defined (Spielberger, 1966, 1972a), trait anxiety (T-Anxiety) refers to relatively stable individual differences in anxiety proneness as a personality trait or disposition, whereas state anxiety (S-Anxiety) is defined as a transitory emotional condition that varies in intensity and fluctuates over time. The 40-item Anxiety Scale Questionnaire (ASQ) developed by Cattell and Scheier (1963) provides an objective measure of individual differences in trait anxiety, and is highly correlated with the TMAS. The IPAT 8-Parallel Form Anxiety scale was developed to assess S-Anxiety by Scheier and Cattell (1960), but there is little evidence of the construct validity of this measure.

The AACL developed by Zuckerman (1960), with adjectives that describe the presence or absence of anxious feelings, assesses both state and trait anxiety. Respondents check each of the 21 AACL adjectives to indicate *how they feel on the day the test is given* (S-Anxiety), and then check these same adjectives to indicate *how they generally feel* (T-Anxiety). The concepts of state and trait anxiety, as refined and elaborated by Spielberger (1966, 1972a, 1972b, 1977, 1979), provided the conceptual framework for constructing the STAI, which was intended to provide reliable, relatively brief, self-report scales for assessing state and trait anxiety in research and clinical practice (Spielberger et al., 1970).

In developing the STAI, the initial goal was to identify a single set of items that could be administered with different instructions to assess the intensity of S-Anxiety and individual differences in T-Anxiety. Items adapted from existing anxiety measures, along with a number of new items, were administered, first with state and then with trait instructions, to large samples of university students and psychiatric patients. Based on extensive item-validity research with more than 2,000 study participants, 20 items were selected for the preliminary form of the STAI. However, subsequent research indicated that altering the instructions could not overcome the strong state or trait psycholinguistic connotations of the key words in a number of items (Spielberger et al., 1970). (For example, "I worry too much" was stable over time and correlated highly with other T-Anxiety items, but scores on this item did not increase in response to stressful circumstances, nor did they decrease under relaxed conditions, as required for the construct validity of an S-Anxiety item. In contrast, "I feel upset" was a highly sensitive measure of S-Anxiety; item scores increased markedly under stressful conditions and were lower under relaxed conditions. However, when given with trait instructions, the scores for this item were unstable over time and correlations with other T-Anxiety items were relatively low.)

Given the difficulties encountered in measuring state and trait anxiety with the same items, the best items for assessing S-Anxiety and T-Anxiety were selected for the STAI (Form X). When given with trait instructions, the 20 items with the best concurrent validity, as indicated by the highest correlations with the TMAS and the ASQ, and that were stable over time, were selected for the T-Anxiety scale (Spielberger et al., 1970). The 20 items with the best construct validity when given with state instructions,

as indicated, respectively, by higher and lower scores under stressful and nonstressful conditions, were selected for the S-Anxiety Scale. Only 5 of the 20 items met the validity criteria for both scales. The remaining 15 items were relatively unique measures of either state or trait anxiety. Further insights gained in more than a decade of research, which contributed to clearer conceptual definitions of the concepts of state and trait anxiety, stimulated a major revision of the STAI. The item selection and validation procedures that guided the replacement of 30% of the original items are described in detail in the revised STAI (Form Y) Test Manual (Spielberger, 1983).

In the construction and standardization of the STAI (Form Y), more than 5,000 additional subjects were tested. Factor analyses of the Form Y items identified distinct state and trait anxiety factors (Spielberger, Vagg, Barker, Donham, & Westberry, 1980), which were similar to those found in previous factor studies of the Form X items (Gaudry, Spielberger, & Vagg, 1975). However, the Form Y factors were more differentiated and had better simple structure than the corresponding Form X factors, reflecting "purer" measures for assessing state and trait anxiety in adolescents and adults, and a better balance in the number of T-Anxiety present and absent items (Spielberger et al., 1980). Since the STAI was first published more than 30 years ago (Spielberger et al., 1970), this inventory has been translated and adapted in 62 languages and dialects, and cited in more than 14,000 archival studies.

—Charles D. Spielberger and Eric C. Reheiser

See also ANXIETY, HEART DISEASE, AND MORTALITY

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## APPLIED BEHAVIOR ANALYSIS

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*Applied behavior analysis* is the science in which procedures derived from the principles of learning are systematically applied to address problems of social significance. Burrhus F. (B. F.) Skinner, for many years a professor at Harvard University and, arguably, the most famous psychologist of the 20th century, studied learning processes in both laboratory animals and humans, carefully delineating a behavioral principle known as operant conditioning. Operant conditioning, the central principle of applied behavior analysis, refers to a process in which the future probability of a behavior is powerfully controlled by both its positive and negative consequences. In 1968, the

growing relevance of this approach to addressing social problems was recognized with the publication of the first issue of the *Journal of Applied Behavior Analysis* and, subsequently, further extended in 1999 to community venues with the publication of the first issue of the *Journal of Positive Behavior Interventions*. The approach has been used with both children and adults in settings related to education, the community, the workplace, the family, and, of particular relevance, health.

## BASIC CONCEPTS

The key concept in understanding operant conditioning is that of the three-term contingency, referring to a sequence of events that consists of antecedent discriminative stimuli ("trigger" stimuli), behavior, and consequences. Operant behavior is influenced by the temporal and functional relationships it has with its antecedents and consequences. In illustration, consider a child whose parent presents a request ("Please put away your toys."). The child may respond with either of two behaviors: compliance or tantrums, depending on the consequences that have followed these behaviors in the past. Some consequences for compliance, for example, parental praise, may have the effect of increasing the future rate of the behavior. When a behavior is followed by the *presentation* of an event (in this case, praise) that increases the future rate of the behavior, the consequence is referred to as a positive reinforcer. The future rate of a behavior can also be increased by *removing* an event following a particular behavior in which case the consequence is referred to as a negative reinforcer. For example, if the parent responds to the child's tantrums by no longer insisting that the toys be put away, the child may become more likely in the future to respond to such requests by throwing a tantrum. In this case, removal of the request to put the toys away functions as a negative reinforcer for tantrums.

Other consequences function to decrease the future rate of behavior. These are referred to as punishers. For example, the parent may *present* an event such as a loud reprimand whenever the child throws a tantrum. The effect, at least in the short term, may be a cessation of the tantrum. In this case, the reprimand functions as a punisher. The future rate of a behavior can also be decreased by *removing* an event following display of the behavior. For example, the parent may send the child to his or her bedroom following

the display of tantrums. This procedure, technically known as timeout, may produce a decrease in the future rate of tantrums. In timeout, punishment involves the removal of many potential positive reinforcers; that is, while the child is sitting in the bedroom, there is no possibility of playing with toys, watching television, or socializing with parents, the absence of which constitutes an aversive (punishing) consequence for tantrums.

Finally, antecedent stimuli also influence operant behavior through their association with past consequences. In illustration, using the previous example, if a mother responds to her child's tantrums by withdrawing her request to put away the toys but the father responds by sending the child to timeout, then the child is likely in the future to display tantrums when the mother makes the request and compliance when the father does so. Technically, this outcome illustrates the phenomenon of stimulus control in which different antecedent stimuli (i.e., requests from mother vs. requests from father) are associated with different rates and types of operant behavior because of differing histories of consequences associated with each of the antecedent stimuli.

The basic concepts just described have been used to achieve a variety of goals relevant to health issues, especially with children. In what follows, several generic goals pertinent to these issues are presented with illustrative examples.

### FACILITATING MEDICAL DIAGNOSIS

Operant conditioning has been used to ensure patient cooperation during complex diagnostic procedures. An example involves magnetic resonance imaging (MRI) for very young children. Keith Slifer and his colleagues at Johns Hopkins University School of Medicine worked with four children, ages 5-6 years. Typically, children this young are sedated prior to MRI scans because the accuracy of such scans depends on the patient remaining still for 20 minutes or more, a difficult task for young children. Also, the scanners are quite noisy and may engender fear, further reducing cooperation. Although sedation can overcome these difficulties, it can also produce undesirable side effects such as respiratory depression. Therefore, as an alternative to sedation, Slifer and colleagues incorporated an operant conditioning component into the diagnostic procedure. Specifically, they altered the MRI environment so that the child could

view an interesting cartoon while lying in the machine. Viewing the cartoon videotape was contingent on body movements of 2 mm per second or less; anything greater than that caused the cartoon to stop for 3 seconds. Thus, lying still was positively reinforced. Furthermore, the more times the children met the criterion, the more treats and prizes they earned later. This reinforcer package produced very low rates of movement, compatible with accurate imaging. Although research is needed to determine whether these procedures are equally applicable to elective versus emergency MRI scans, they appear to offer practitioners a potential alternative to sedation that is developmentally appropriate as well as increasing patient comfort and compliance.

### ADHERENCE TO MEDICAL REGIMENS

The fact that an individual has been prescribed an effective drug for a medical condition is no guarantee that the individual will faithfully adhere to the prescribed course of treatment. In the case of a serious illness such as asthma, this lack of adherence could have fatal consequences. Irene da Costa and her colleagues at the University of Kansas Medical Center worked with two asthmatic children, 8 and 10 years of age, who were referred by an allergist for poor adherence to a medical regimen that consisted of inhaling the drug beclomethasone several times a day. Adherence was assessed with an electronic monitor, attached to the inhaler, that recorded and stored the date and time of each inhaler actuation.

To motivate the children, the investigators used a token system, the technical term for a reinforcement approach that, in the present case, involved the children earning points for taking medication, and losing privileges for not doing so. When sufficient points had been accumulated, the children could exchange them for a variety of special privileges. The points and back-up privileges thus served as reinforcers for compliance, and the loss of privileges, as punishers for lack of compliance. Over a period of several weeks, during which the token system was evaluated, adherence rose to high levels. In all likelihood, additional procedures would be needed to produce long-term impact on behavior and health. However, many medical conditions require only short-term management and, therefore, reinforcement approaches may offer promise as a strategy for promoting adherence.

## ADJUNCT TO MEDICAL INTERVENTION

During the course of medical intervention, problems sometimes arise that are not resolved solely by the use of the intervention itself. In these instances, operant conditioning procedures can prove to be a useful adjunctive treatment. An example comes from a study of pediatric burn victims carried out by Mary Lou Kelley and her colleagues at the University of Mississippi Medical Center. Two girls, 4 and 6 years of age, were receiving hydrotherapy for extensive body burns. This medical intervention involves sitting in a whirlpool tub after which dead skin is removed and dressings are applied. The procedure was aversive to the children, producing verbal pain (e.g., screaming), motoric pain (e.g., flailing, aggression), high levels of fear, and low levels of cooperation.

A procedure was designed whereby the children were encouraged to watch amusing cartoons during hydrotherapy and told it would help them to “forget” about their pain and make the time go faster. The children were also told that they could place a “star” (reinforcer) on a chart for every session that an adult judged their “pain” behavior to be less than they had shown prior to the cartoon/star intervention. This strategy produced a decrease in both verbal and motoric pain behavior, measured directly. In addition, the children’s mothers and physical therapists rated the children as showing lower levels of pain and fear as well as higher levels of cooperation. Using the terminology described earlier, the cartoons likely functioned as discriminative stimuli for socially appropriate behavior, and stars as reinforcers for the occurrence of behaviors that expressed diminished levels of pain. While these operant procedures were unlikely to have reduced the subjective experience of pain, they had a desirable impact on the negative behavioral and affective sequelae associated with an unpleasant medical intervention.

## REDUCING UNHEALTHY BEHAVIOR PATTERNS

During the course of their lives, many people learn behavior patterns that ultimately produce negative health consequences. A good example concerns poor eating habits that result in obesity, a widespread problem correlated with heart disease, cancer, and other serious illnesses. Typically, obesity is dealt with through a combination of diet and exercise programs. However, Richard Stuart, formerly of the University of

Michigan at Ann Arbor, proposed that the impact of these programs could be enhanced by the additional use of operant conditioning principles to alter unhealthful eating patterns. Stuart’s suggestions are often incorporated into obesity management programs for both children and adults, and have been shown to contribute to controlling weight in the short and long term.

One strategy, defined earlier, involves stimulus control. Specifically, individuals are taught to eliminate discriminative stimuli that trigger poor eating, for example, by removing junk foods from the house, by immediately throwing meal leftovers into the garbage rather than having them available for subsequent snacking, by food shopping only after consuming a full meal to avoid hunger-driven impulsive eating in the store, and by eating in one room only to ensure that multiple sites do not become associated with and, therefore, trigger eating episodes. Also, alternatives to unhealthful eating patterns are positively reinforced. That is, arrangements are made with family members and friends to ensure that they recognize and praise the person as weight is lost (“You look 10 years younger!”). When weight goals are met, material consequences are programmed. For example, the person now purchases elegant clothing appropriate for a “slim” person or goes on a special vacation as a reward. In sum, by focusing on changing the antecedents and consequences for eating behavior rather than focusing exclusively on weight loss, one teaches individuals long-term strategies for controlling their unhealthful eating patterns, thereby potentially contributing to future health.

## MOTIVATING HEALTHY BEHAVIOR

The principles of applied behavior analysis have also been used to motivate healthy behavior. For example, rather than waiting until children become obese before acting, some investigators have tried to prevent such problems by intervening early. Lori Stark and her colleagues at the Brown University Medical School worked with preschool children who had, as yet, no weight problems. They offered these children a variety of snacks, some healthy (e.g., fruits and vegetables), some unhealthy (e.g., chips and cookies). When a child selected a healthy food to eat, he or she received positive reinforcement in the form of teacher praise as well as preferred colorful stickers (e.g., those depicting rainbows, hearts, cars). Unhealthy choices received negative feedback (i.e., feedback that educated the child regarding healthy versus unhealthy foods; for example,

“You picked a cookie. Cookies aren’t as good for you as fruits or vegetables.”). In addition, the children were taught to solicit teacher praise following a healthy choice (e.g., “I picked a good snack, didn’t I?”).

This program was in effect during the school year and was also extended to the home. The outcome was that the children reliably selected healthy foods at a high rate that far exceeded the rate of such choices before the program was implemented. Given these positive results, a clear priority would be to follow up this study to determine the long-term health benefits of such an intervention. At a minimum, however, the study demonstrates the potential utility of operant conditioning strategies for promoting the early development of good nutritional practices.

In sum, applied behavior analysis has proven useful in helping to address a number of generic issues of importance in the field of health, including facilitation of medical diagnosis, adherence to medical regimens, adjunctive medical intervention, reducing unhealthy behavior, and motivating healthy behavior as a strategy for the prevention of future illness.

—Edward G. Carr

See also ADOPTION OF HEALTH BEHAVIOR; CHRONIC DISEASE MANAGEMENT

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## ARTHRITIS: BEHAVIORAL TREATMENT

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Arthritis refers to a group of more than 100 disorders in which the joints become damaged, often as a result of inflammation. There is no known cure for arthritis and as such, it is a common condition that is usually chronic in nature and causes significant pain and disability. Although disability in arthritis is associated with damage to the joints that can be identified through examinations (such as X-rays), damage does not entirely predict the level of function that individuals achieve. Indeed, it has long been recognized that psychological factors, such as attitudes toward illness, coping styles, depression, and anxiety are also important predictors of function over time.

One model that has been adapted to explain the process of adjustment to arthritis is the self-regulation model. According to this model, people have beliefs about arthritis prior to being diagnosed. These beliefs influence the way in which people cope with the illness. For example, if people believe that arthritis is a serious condition, which is likely to be chronic and disabling and over which they have no control, they may be inclined to do little to actively cope with the illness and instead rest. When they rest, the acute pain improves and hence they appraise the coping strategy of resting as helpful, increasing its use. In addition, there is also an emotional response to the symptoms, such as fear or anxiety. People with arthritis will then attempt to cope with these negative emotions, such as through avoidance of activity. Again, avoidance will lead to an immediate reduction in anxiety, promoting its use as a coping strategy in the future.

The importance of attitudes, coping, and subsequent behavior in response to illness has led to the development of psychological treatments for arthritis. On the basis of models that emphasize the role of attitudes and behaviors, the most commonly evaluated of the psychological treatments is known as behavioral or cognitive-behavioral treatment or therapy (CBT). Cognitive-behavioral treatments refer to interventions that aim to help people to change their behavior and/or attitudes toward the illness in a way



that will facilitate physical and psychological adjustment to their symptoms. CBT interventions commonly use a range of different strategies with the aim of helping patients to self-manage their symptoms. Although most of the research has been conducted with patients with rheumatoid arthritis, it is likely that these approaches would also be helpful to people with related disorders, such as systemic lupus erythematosus, ankylosing spondylitis, or Sjogren's syndrome.

## BEHAVIORAL THERAPY

There are two very different approaches that constitute behavioral treatments: operant programs and self-management.

### Operant Programs

Operant programs are based on the principles of operant conditioning. That is, behaviors are learned according to whether rewards or punishment follow the performance of those behaviors. For example, if a person with arthritis is in pain and engages in a pain behavior (e.g., grimacing or holding painful areas), relatives may realize that the person is in considerable pain and give the person extra attention (positive reinforcement) or take over his or her duties (negative reinforcement). These responses to the pain behavior will result in the person learning to express his or her pain through performing various behaviors that indicate that the person is in pain.

The early behavioral approaches to chronic pain management used operant approaches to reduce the performance of pain behaviors and to reduce downtime (i.e., the time that people spend resting). Operant approaches train the family members of people in pain to give attention and other rewards to "well" behaviors, while ignoring times that the person with arthritis engages in pain behavior. As a result, people with arthritis are encouraged to increase their activity and appropriate communication about pain, while reducing their reliance on pain behaviors and rest. Although operant programs were popular early in the development of behavior therapy for chronic pain patients, they have rarely been applied specifically to people with arthritis. More popular in recent decades have been behavioral approaches that encourage people with arthritis to actively manage their symptoms appropriately.

### Self-Management Approaches

Self-management approaches are largely based on stress and/or pain management principles. The behavioral strategies aim to help people with arthritis change their behavior in a way that will allow them to better manage their symptoms. This includes encouraging people to achieve an optimal balance between rest and exercise, learning to relax, manage stress more effectively, and communicate with others in asking for help, when required. The most commonly employed strategies are activity pacing and goal setting, problem solving, relaxation and/or biofeedback, and assertiveness and communication. Most commonly, behavioral treatments involve some combination of these different strategies.

#### *Pacing and Goal Setting*

It is increasingly recognized that it is important for people with arthritis to maintain a balance between rest and exercise. In arthritis, excessive rest typically results in the joints becoming stiff; that, in turn, leads to a reduction in the person's function. On the other hand, excessive activity on inflamed joints (such as in rheumatoid arthritis) can be damaging and lead to increased disability. Hence, it is important for people with arthritis to learn to balance rest and exercise by pacing their activities across the days and weeks and setting realistic goals. Given that most forms of arthritis are marked by their unpredictability, an appropriate balance of activity can be difficult to achieve. People with arthritis often develop bad habits of overdoing things when they feel well (in case tomorrow is a bad day), only to find that their activity leads to a flare-up in symptoms requiring them to rest the following day.

#### *Problem Solving*

Arthritis creates a range of problems in people's lives from how to manage particular tasks (such as turning on taps) to work and finance-related issues. Problem solving typically makes a number of stages of the process of solving problems explicit. These include brainstorming possible solutions, reviewing the consequences of those solutions, choosing a course of action, and implementing the most helpful solution. For people with arthritis, problem solving can be helpfully applied to the activities of daily living that become problematic as a result of limitations to function.

### *Relaxation and Biofeedback-Based Strategies*

Most behavioral self-management programs include a component that teaches people relaxation strategies. Relaxation exercises often consist of progressive muscular relaxation where people with arthritis are taught to tense and relax different muscle groups throughout the body. However, other programs include similar relaxation exercises without tension cycles and with the use of imagery to facilitate relaxation. In the 1980s, it was common for biofeedback, the provision of information about a particular aspect of the body's functioning, to be used to assist people with arthritis in achieving relaxation. Although less popular in recent years, many of the behavioral programs that have been evaluated have included biofeedback.

In the arthritis literature, two types of biofeedback have commonly been employed: thermal biofeedback and muscle biofeedback (electromyography) or EMG biofeedback. Thermal biofeedback gives people immediate feedback of their body temperature, and its application to arthritis is based on the assumption that there are problems with circulation in patients with some forms of arthritis, such as rheumatoid arthritis. People with rheumatoid arthritis would be attached to a biofeedback machine, usually to a finger, which would provide information about the skin temperature. People are then encouraged to use a range of relaxation or imagery techniques in order to warm that area. Research shows that people can learn to gain better control over their skin temperature, although it is unclear whether this translates to clinical benefits. EMG or muscle biofeedback works on a similar principle, but gives feedback about the level of muscle tension in a particular muscle group of the body. The application of EMG biofeedback is based on the pain-tension-pain cycle. That is, when individuals are in pain, they are likely to tense their muscles as a reaction to the pain (or in anticipation of pain) and this tension, in turn, exacerbates the pain. Hence, it is argued that EMG biofeedback can facilitate people's acquisition of relaxation skills by providing immediate feedback about the level of muscle tension in a particular region. Furthermore, with EMG biofeedback, people with arthritis can be taught to apply relaxation strategies to stressful situations and/or activities that they need to complete.

### *Assertiveness and Communication*

Arthritis almost inevitably affects a person's level of function in some way. As a result, role expectations

change. People themselves can find it difficult to accept these changes in role functions, but changes in expectations also have an impact on those around the individual, including their families, friends, and coworkers. People with arthritis can find it difficult to communicate about their needs in a helpful way and yet such communication is very important. This is particularly so early in the course of the disease. For example, the literature suggests that a large proportion of people who develop rheumatoid arthritis will lose their employment within the first 2 years of illness and that employment status is an important predictor of long-term outcome. Therefore, helping people to communicate assertively with their employers about the impact of their illness on their work is essential in trying to maintain employment, where appropriate.

In teaching patients about communication, the differences between behaving in a passive, assertive, or aggressive manner are usually described or demonstrated. Examples are usually taken from people's lives, and role-plays can be used where people with arthritis can practice different ways of communicating. A focus is not only on the nature of the verbal content of communication but also on the nonverbal signals that accompany the person's message. While many people with arthritis will have good communication skills, they often have some reticence in behaving assertively in various situations that they encounter. Common situations that people identify as needing assertive skills include talking with doctors and asking for help from other people. The aim of assertiveness is to help people understand their rights in various situations and balance their rights with those of other people, allowing open communication between the parties to occur.

### COGNITIVE THERAPY

Cognitive therapy was initially developed for the treatment of depression, and it is a well-established and effective treatment for mood disorders. Symptoms of depression are more common in individuals with chronic illness than in the general population, and this includes patients with arthritis. Hence, cognitive strategies are likely to be helpful to those individuals who are depressed as a result of their illness or its limitations. However, cognitive therapy also has an important role more generally in helping people cope with arthritis. Attitudes toward illness are associated with adjustment. For example, those

people with arthritis who believe that the illness is uncontrollable have been shown to have much poorer adjustment to illness than those who believe that they can control their symptoms. As a result of findings that emphasize the importance of attitudes toward illness, cognitive strategies are frequently employed in behavioral self-management approaches to facilitate the effectiveness of the behavioral components of treatment.

For example, assertiveness skills can be practiced from a behavioral point of view through practicing the verbal and nonverbal behaviors that correspond to assertive communication; however, some people with arthritis hold views that prevent them from using these skills, such as worrying that they are a burden to others or not wanting to question their doctor. The attitudes that prevent individuals from behaving assertively can be addressed through using cognitive strategies, such as cognitive restructuring. Similar attitudes can prevent individuals from using other behavioral strategies. For example, individuals who believe that they should be able to maintain a high level of function, despite their arthritis, find pacing particularly problematic and may be at risk of becoming overactive.

### Attention Diversion

One of the most common symptoms of arthritis is joint pain. Pain interferes with an individual's ability to concentrate on tasks because it is difficult to remove attention away from the source of the pain. As the pain becomes more severe and more chronic, the degree to which people can ignore the pain reduces further. Research has found that the way in which individuals with arthritis cope with the pain predicts the amount of pain that they experience. Hence, teaching patients coping strategies for dealing with the pain and being able to keep their attention on other factors is a helpful part of psychological treatment.

Many people with arthritis develop very helpful ways of dealing with their pain independently, and the aim of attention diversion strategies is to build further on these helpful resources. People are taught to use nondemanding physical activities and mental strategies to take their mind off the pain. Typically, these are helpful in managing mild to moderate levels of pain. Some people with arthritis find the use of imagery directed toward the pain very helpful in dealing with more severe levels of pain. For example,

those who feel that their pain is like burning can use imagery to imagine the pain becoming cooler and cooler. As people develop individual images and practice these, such cognitive strategies can be very helpful for managing more severe levels of pain and allowing people with arthritis to use more traditional attention diversion strategies, such as engaging in a nondemanding activity or mental activity.

### Cognitive Challenging

The cornerstone of cognitive therapy relies on cognitive restructuring. People with arthritis are helped to understand the relationship between situations that arise, the meaning of those situations, and the emotions that they experience. For example, if a person with arthritis drops a cup and breaks it due to weakness in their hands, it is not the broken cup that is usually associated with feeling upset. Rather, dropping the cup is sometimes interpreted as meaning that the person is no longer able to cope with daily life or is becoming weak or disabled. Through keeping a record of their thoughts, people can become aware of these automatic thoughts that are unhelpful and contribute to levels of distress. Cognitive therapy allows people with arthritis to learn ways to question these unhelpful thoughts. Furthermore, underlying attitudes or fears about arthritis can be identified and challenged. Many people fear that they will end up in a wheelchair or become a burden to their family. Such beliefs are often unlikely particularly since new treatment approaches have improved outcome for people with arthritis. Challenging unhelpful beliefs such as these can often improve the emotional well-being of people with arthritis.

## OTHER STRATEGIES

### Education About Arthritis

Psychoeducational programs about arthritis are often available, many of them based on the work of Kate Lorig and James F. Fries and *The Arthritis Helpbook* (1990), which provides excellent information for people with arthritis. Education, while not itself a behavioral strategy as such, is frequently included in behavioral or cognitive-behavioral interventions. Research suggests that education about arthritis does improve people's knowledge about the disease and also their self-efficacy (i.e., their confidence that they can manage the illness and its

symptoms). However, education alone is often not sufficient to induce behavioral change. Nonetheless, education does seem necessary to help people understand their illness and the symptoms and is a good basis from which to add further cognitive and/or behavioral skills.

### Stress Management

Stress management is a generic term for a set of cognitive and/or behavioral strategies to help individuals better manage stress. In terms of the strategies that form the basis of stress management, they are largely indistinguishable from those listed above. The difference between stress management and pain management is largely in the focus on managing either pain or stress—the approach is otherwise the same. Stress management is often applied to chronically painful conditions, such as arthritis, on the assumption that the condition increases stress, which, in turn, exacerbates the illness.

### Supportive Counseling

Supportive counseling or psychotherapy refers to providing support and empathy to people with arthritis, without specifically including any skills or strategies. All cognitive and behavioral therapies should be administered within a supportive and collaborative therapist-client relationship. The major difference between supportive counseling and cognitive or behavioral therapies parallels the respective aims of these treatments. The primary aim of supportive counseling is to provide a person with arthritis with support in a nonjudgmental relationship, whereas the primary aim of behavioral therapies is to change people's behavior and of cognitive therapies is to change their attitudes.

### MODE OF TREATMENT ADMINISTRATION

Cognitive and behavioral therapies are most commonly administered in either a group or individual setting. The advantage of individual treatment is that interventions can be individualized to meet the needs of a particular person with arthritis. Since the outcome of people with arthritis varies enormously so too do their needs. Group treatment, on the other hand, has the benefit of people with arthritis meeting one another, which can provide increased support and can

help to normalize people's experiences. It is important that groups are composed of people with similar disease severity to ensure that those people who are less affected by arthritis or are early in the disease process do not become overly concerned about the possibility of deformity and disability that they observe among other group participants.

Self-help educational material is also available, but it is unclear whether cognitive and behavioral skills can be well learned through self-administration. Self-administered pain management has been found to be as effective as individually administered treatment for those people with chronic pain problems who complete a specified manual, but many people fail to complete and the outcome for those people is unknown. Research with people with arthritis has shown that keeping a daily diary of stressful experiences can be effective in improving outcomes for people with rheumatoid arthritis, and so it is possible that self-administered interventions may have value for people with arthritis.

### EFFECTIVENESS OF TREATMENT

There are more than 60 controlled clinical trials of psychological or behavioral interventions in comparison to either standard care or another treatment for people with rheumatoid arthritis alone. Astin, Beckner, Soeken, Hochberg, and Berman (2002) recently conducted an analysis of all the trials that met criteria for being methodologically rigorous. They identified 25 high-quality trials, the majority of which included some cognitive and/or behavioral strategies. Their results suggest that across all the published research of good quality, psychological treatments effectively reduce pain and improve disability, joint function, coping, depression, and self-efficacy immediately following treatment. In the longer term, people with rheumatoid arthritis appear to continue to improve over time with regard to psychological functioning, joint function, and coping, although their pain and disability return to previous levels. In all of the studies reviewed, people with rheumatoid arthritis were not chosen on the basis that they were having difficulty coping or had psychological problems, *per se*. Hence, these results suggest that for people with rheumatoid arthritis, cognitive and/or behavioral treatments can be helpful in addition to medical care.

Similar results have also been shown for people with osteoarthritis, where studies that have been conducted

largely suggest that cognitive and/or behavioral treatments are likely to be helpful as an adjunct to medical treatment. Although other less common forms of arthritis have rarely been the subject of controlled studies, there is no reason to think that similar approaches to treatment would not be equally effective.

### WHO BENEFITS FROM TREATMENT?

Although the effectiveness of CBT for people with rheumatoid arthritis and osteoarthritis seems likely, little is known about which people with arthritis will benefit most from behavioral treatments. People with arthritis who are severely affected and have high levels of disability that have been progressing over the course of the illness do most poorly. Moreover, cognitive-behavioral treatment has been used for people who have been diagnosed with rheumatoid arthritis more recently. Indeed, results are more positive in trials where the illness duration is shorter and those studies that have followed up people with arthritis over time have found that treatment benefits are largely maintained and in some cases further improvements emerge over time. If treatments are effective in people recently diagnosed with arthritis and improvements are maintained, then early administration of treatment can prevent deterioration in disability and the development of psychological problems in reaction to the illness. Hence, it seems likely that the earlier in the course of the arthritis that a person is offered behavioral treatment the more effective treatment is likely to be.

### HOW DO THE TREATMENTS WORK?

The question of how behavioral treatments work is difficult to answer. The question is complicated by the fact that most research has included a number of different cognitive and/or behavioral strategies. As a result, whether there is one particular strategy that accounts for the observed changes in people with arthritis or whether a combination of strategies work together to produce change is unclear. For example, it may be that teaching people with arthritis ways to pace their activity is necessary and sufficient for change. Alternately, it may be that pacing activity is necessary, but not sufficient. Rather, people with arthritis may need to change the attitudes that prevent them from being too active or not active enough in order to make the necessary behavioral changes. At

present, we do not know which strategies are most important or effective.

Although there is no clear answer to which treatment components are effective by themselves or in combination, there is some indication about what possible factors may produce change. For example, many of the studies have investigated disease variables and few of the studies have been able to produce changes in the actual progression of disease for people with arthritis. Therefore, it seems unlikely that the interventions are successful through improving the biological markers of disease (such as acute inflammation in rheumatoid arthritis). Nonetheless, people with arthritis who complete behavioral treatments do improve with regard to joint function.

One factor that has been consistently observed to predict treatment-related changes has been self-efficacy. That is, people with arthritis who become more confident in their ability to manage the disease and its symptoms appear to be those who make the largest improvements. It may be that as people gain increased confidence their mood improves and they subsequently engage in more helpful behaviors relating to their arthritis, such as balancing rest and exercise more appropriately. This interpretation would be consistent with biopsychosocial models of arthritis, but it remains speculative. The precise mechanisms through which cognitive and behavioral treatments work have yet to be clearly identified.

—Louise Sharpe

See also ARTHRITIS: PSYCHOSOCIAL ASPECTS; CHRONIC ILLNESS: PSYCHOLOGICAL ASPECTS; CHRONIC PAIN MANAGEMENT; RHEUMATOID ARTHRITIS: PSYCHOSOCIAL ASPECTS

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## ARTHRITIS: PSYCHOSOCIAL ASPECTS

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Within the past century, scientific and medical advancements have been successful in preserving physical health and preventing and treating acute, infectious diseases (e.g., polio, tuberculosis) that negatively affected population health. These accomplishments, coupled with growth in the size and longevity of the older population, have shifted the attention of medical and public health professionals to the prevalence and incidence of chronic medical conditions (e.g., hypertension, arthritis). Research and clinical treatment now focus more specifically on the means to prevent and treat these conditions and to ameliorate their potential harmful impact on physical health and psychological functioning.

Arthritis is one of the most common nonfatal chronic diseases in the United States, and it is the leading cause of pain and physical disability, particularly among adults 65 years of age and older. Derived from the Greek words *arthron* (joints) and *itis* (inflammation), arthritis is a general term used to describe more than 100 different conditions that affect the joints and/or connective tissues (e.g., muscles, tendons). The most common of the arthritis conditions are *osteoarthritis*, which is a musculoskeletal disease

that causes deterioration of the cartilage, and *rheumatoid arthritis*, an autoimmune disease that causes inflammation of the joint lining.

A number of psychosocial factors have been associated with arthritis and have a major impact on the experience of the disease. Psychosocial factors are defined as psychological, behavioral, and social processes that include beliefs, values, perceptions, culture, coping behaviors, personality indicators, and social resources and networks (e.g., social support), all of which can influence how the individual detects, interprets, and responds to the arthritis condition. Sociodemographic factors such as age and gender are also associated with variability in arthritis conditions. For example, certain age cohorts are more likely to develop specific types of arthritis conditions compared to other age groups (i.e., women 65 years of age and older are more likely to experience osteoarthritis compared to women 35 years of age and younger). Psychosocial factors account for significant variation in the physical and behavioral manifestations associated with arthritis and affect the severity and course of the medical condition. Although there are a myriad of psychosocial factors that can influence the outcome of having an arthritis condition, this entry will focus on two indicators (i.e., pain, depression) that are pertinent to physical ability and functional limitations.

## PAIN, CULTURE, AND ARTHRITIS

*Pain* is defined as an unpleasant sensory and emotional experience that affects an individual's physical and psychological health and social well-being. Pain is the cardinal manifestation of an arthritis condition and is often chronic (lasts for an indefinite amount of time), severe, and unpredictable. The experience of pain not only is a major health concern for individuals with arthritis but is a significant predictor of current and future medication use, future pain experiences, and subsequent physical disability.

The intensity of the pain associated with arthritis may result from physiological changes such as joint damage, tissue inflammation, excessive tension and swelling within the joint capsule, and physical activity. The pain experience varies from patient to patient and is contingent on a myriad of factors including the history of the illness, the duration of the medical condition, type (acute vs. chronic) and location of the pain, variability of daily pain and the number of painful days, number of joints affected, physiological

changes (e.g., changes to the body's tissue structure), side effects of medications, and the racial and ethnic (cultural) background of the affected individual.

Although the biological sensations of pain are universal, the meaning, attitudes, and responses to the pain experience differ across racial and ethnic groups. Many racial and ethnic groups have specific "pain rituals" that shape an individual's expectations and beliefs about pain, as well as strategies to tolerate the pain experience. For example, differences in language, ways of understanding and expressing health and disease, the expression and the meaning of pain; preferred modalities of health care management and treatment; and the use of specific strategies to cope with pain are among the many factors that comprise the experience and cultural context of pain.

### PHYSICAL DISABILITY AND ARTHRITIS

In the United States, arthritis is the primary cause of the inability to perform various routine tasks (e.g., personal care, household, work related) and leisure activities. Approximately 3% of the U.S. population report that arthritis significantly impairs their ability to perform certain physical activities such as walking, bathing, and dressing (Centers for Disease Control and Prevention, 1994). Many individuals spend a quarter of their lives in a state of physical disability, infirmity, and/or injury. These circumstances are significantly associated with primary care physician utilization, hospitalizations, increased nursing home admissions, and mortality. The physical limitations associated with arthritis involve a process in which muscle weakness leads to unstable joints; the resulting stress that is exerted on unstable joints causes pain and disability. Paradoxically, attempts to avoid the pain associated with normal activities may lead to increased muscle weakness, which initiates a cycle of activity avoidance, pain, and physical disability.

### ARTHRITIS AND DEPRESSION

Depression is a common clinical disorder for both acute and chronically ill patients. Approximately one third of all patients with a chronic medical condition experience increased rates of depressive symptomatology. Depression is considered the most psychologically debilitating outcome of arthritis. Existing evidence indicates that the pain and physical disabilities resulting from arthritis are significant predictors

of depression. Differences in the experience of depressive symptoms are contingent on the severity of the medical condition, the body system (e.g., musculoskeletal) involved, and the patient's ability to maintain a positive body image, while acknowledging the loss of parts and/or of function. Factors such as location of the arthritis condition (e.g., knees, hands), total number of affected joints, type of arthritis condition (e.g., rheumatoid arthritis, osteoarthritis), and extent and type of physical limitations all have an influence on level of physical capacity which, in turn, affects the incidence and prevalence of depressive symptoms.

Systematic exploration of the psychosocial factors associated with arthritis conditions will help to identify the social, psychological, physical, and cultural factors that influence the patient's experience of the disease, as well as to understand the coping strategies that individuals use to combat its deleterious physical, psychological, and social outcomes.

—Tamara A. Baker

See also ARTHRITIS: BEHAVIORAL TREATMENT; CHRONIC PAIN MANAGEMENT; DEPRESSION: TREATMENT

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## ASIAN AMERICAN/PACIFIC ISLANDER HEALTH AND BEHAVIOR

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Asian Americans and Pacific Islanders (AAPIs) comprise the fastest growing group in the United States, yet knowledge about the status of this population

**Table 1** Growth Rate and Size of the Largest Asian American and Pacific Islander (AAPI) Groups, 1990-2000

Chinese	+48%	2.5 million
Filipino	+36%	1.9 million
Asian Indian	+106%	1.7 million
Vietnamese	+83%	1.1 million
Korean	+35%	1.1 million
Japanese	-6%	796,700
Other	+65%	
Total AAPIs in 2000		10,412,610

SOURCE: U.S. census 1990 and 2000.

is severely hampered by several factors: the invisibility of the population, the lack of data on the population as a whole as well as its constituent subgroups, the extreme diversity within the category AAPI, and assumptions about the health of this population, since little data exist to the contrary. The AAPI umbrella term encompasses persons whose familial origins are in the Far East, Southeast Asia, the Indian subcontinent, and the Pacific Islands. Prior to 1965, AAPIs comprised less than 1% of the U.S. population. The 1965 removal of national quotas in the immigration law has resulted in triple-digit growth each decade until 1990. The past decade saw a 50% increase in the total population, and AAPIs now make up almost 4% of the U.S. population, more than 10 million people (see Table 1). Demographic predictions show that by 2020, 6% or 20 million Americans will be of AAPI heritage. Over 75% of AAPIs live in seven states (California, Hawaii, New York, New Jersey, Texas, Illinois, and Washington), and by 2020, will be dispersed throughout the country.

Perhaps the most important note regarding this group is that the term *Asian American and Pacific Islander* is an ethnic gloss that aggregates more than 50 highly diverse national groups with very different beliefs, cultures, and, importantly, epidemiological patterns of health outcomes. Generalizations about this group as a whole are not valid. The health status of members of this population reflects wide between- and within-group differences and identifies the groups at highest risk for morbidity and mortality from various diseases. Researchers, however, are limited by the critical lack of valid, disaggregated, population-based data on the various AAPI population groups for most diseases.

## EPIDEMIOLOGY

First-generation immigrants comprise 70% of the AAPI population, and, as new immigrants, they are a significantly young population, while groups who have been here for almost 200 years have sixth- and seventh-generation members. Available statistics indicate low rates of most infectious and chronic diseases; however, these aggregated data are erroneous and misleading. Some groups have unusually high rates of some infectious diseases, and overall, AAPIs face rapidly rising rates of chronic illnesses. The top five diseases among AAPIs as a group and for men and women are listed in Table 2.

## CULTURAL INFLUENCES ON AAPI HEALTH STATUS

About 85% to 90% of diseases are related to lifestyle choices such as diet, exercise, smoking, birth rates and age at first birth, changing sexual practices, environmental risks, and other lifestyle changes that come with acculturation, such as use of screening and early-detection practices. Studies of AAPI groups who have migrated to the United States indicate that such lifestyle factors appear to account for a major portion of disease incidence and mortality rates. As AAPIs Westernize their lifestyles, their disease profiles begin to mirror those of the dominant U.S. society, and the change is apparent within one generation (President's Advisory Commission on Asian Americans and Pacific Islanders, 2001; Zane, Takeuchi, & Young, 1994). Some diseases, such as breast cancer and diabetes, are occurring at an even higher rate than for non-Hispanic White Americans. The patterns of change, however, are not uniform across groups and vary due to differences in traditional cultural practices, immigration histories, levels of acculturation to dominant American lifestyles, and socioeconomic constraints.

Thus, as noted, generalizations about this group are extremely problematic. Because the variables listed above affect the incidence, prevalence, morbidity, and mortality from diseases, inclusion of these behavioral variables in reporting the health status of any of the AAPI groups would significantly increase the validity of the findings. Each disease report will differ depending on the specific cultural group of focus, its social/historical context, and the gender, age, socioeconomic status, acculturation level, English proficiency, and degree of cultural integrity of the individuals as well as the group members.



**Table 2** Top Five Diseases Among Asian Americans and Pacific Islanders (AAPIs)

<i>All AAPIs, All Ages</i>	<i>Men 45 Years+</i>	<i>Women 25 Years+</i>
1. Cardiovascular diseases	1. Cardiovascular diseases	1. Breast cancer/other cancers
2. Cancers	2. Cancers	2. Cardiovascular diseases
3. Cerebrovascular diseases	3. Cerebrovascular diseases	3. Cerebrovascular diseases
4. Accidents	4. Diabetes Type 2	4. Diabetes Type 2
5. Diabetes Type 2	5. Accidents/chronic lower respiratory	5. Accidents/chronic lower respiratory

SOURCE: *National Vital Statistics Report*, 49(11), October 12, 2001.

Despite the inter- and intragroup variability, some similarities exist among the cultures within the AAPI category, such as religion, traditional healing systems, and health care decision-making processes, but individual variation is paramount.

The major religions of this population either have their roots in or are strongly influenced by Buddhism, Confucianism, Taoism, and Animism. These religions all have a strong inner locus of control and preventive health focus. The basic concept of these worldviews is harmony among the elements utilizing the concept of balance of opposite life forces. Health is a balance of these life forces physically, emotionally, interpersonally, and with nature. The major traditions in healing, such as Ayurveda (East Asian medical system based in Hindu philosophy) or traditional Chinese medicine, can be traced back over several millennia. Native Hawaiians have a system of *pono* or equilibrium as well. Within these systems, the mind, body, spirit, and universal forces function as an integrated system. Balance among these systems is health, and imbalance results in illness. This integrated worldview of mind, body, and spirit produces an awkward interface with Western biomedicine, which separates physical from mental health, and leaves spirituality on the periphery.

In general, traditional AAPI diets, exercise patterns, and social practices seem protective against heart disease, diabetes, and the major cancers in the United States. Traditional AAPI diets are usually high in complex carbohydrates, fruits, and vegetables, and low in saturated fats and total calories.

Traditional diets may also be problematic, however. Some groups consume diets very high in sodium such as soy and fish sauces, and pickled, smoked, and salted foods, which contain nitrates that increase the risk of stomach cancer (the highest rates in the world are in Asia) and peppered foods may also contribute to higher stomach cancer rates. Korean men have the

highest rates of stomach cancer in the United States. South Asians often cook with *ghee*, a type of butter, and fry many foods, and their rates of diabetes and cardiovascular disease are among the highest for AAPIs. According to the National Institute of Diabetes and Digestive and Kidney Diseases, over 90% of Asians and Pacific Islanders are lactose intolerant (see [www.digestive.niddk.nih.gov](http://www.digestive.niddk.nih.gov)), and calcium intake is lower than U.S. diets. Many elderly Asian American women have osteoporosis.

The Westernization of Asian American and Pacific Islander diets has been shown to negatively affect their overall health status. Animal meat and fat generally replace fish as the primary sources of protein. Simple carbohydrates, such as breads, sugared confectionaries, and fast foods, replace more complex carbohydrates, and intake of fresh fruits and vegetables drop dramatically. The rates of cardiovascular disease, diabetes (rates of 15-20% compared to 4% for the U.S. population), and cancers associated with obesity and reduced roughage, such as breast, colorectal, and prostate, are increasing dramatically. Yet certain cancers are reduced compared to their rates in Asia, but still remain higher than Whites, such as Vietnamese men with 11.3 times the rate of liver cancer, Vietnamese women with 8 times the rate of cervical cancer, and Korean men, who have the highest rates of stomach cancer of all ethnic groups. The incidence of tuberculosis is almost 15 times that of Whites for Chinese and Filipinos, and hepatitis B carrier rates are about 14% for AAPIs compared with < 0.2% for the U.S. all ethnicities.

Smoking rates in Asia for men are significantly higher than in the United States, and recent immigrants/refugees bring these practices with them. AAPI men have the highest smoking rates in the United States (ranging from 28% in Chinese Americans to 65% in Tongan and 72% in Laotian and Cambodian men). AAPI women, however, experience the opposite

pattern. Smoking rates are very low in their native Asian and Pacific Islander countries (~2-5%), but are rising rapidly in the United States, as they become more acculturated (5-12%). Young women (ages 16-25) have rates of 20% to 40% on informal surveys.

Physical activity seems to be extremely low in AAPIs. For example, in the 1999 Behavioral Risk Factor Surveillance System (BRFSS, a state-based system of health surveys) in Hawaii, the physical inactivity level for Caucasians in Hawaii was approximately 68%, whereas for all the AAPI groups, the range of inactivity was 70% for part-Hawaiians to 79% for Chinese.

Drinking behavior among particular AAPI groups is significantly different from the general U.S. population. On the whole, AAPIs who drink habitually drink more per day than any other racial/ethnic group, and between 1994 and 1999, AAPI substance abuse treatment admissions rose by 52%.

#### TRADITIONAL HEALTH PRACTICES AND HEALTH CARE DECISION MAKING

At least 20% to 70% of AAPIs use traditional healing practices preventively, sequentially, or concurrently with Western biomedicine. Many of the traditional practices are effective, such as massage, acupuncture, and herbs. When used concurrently with biomedical drugs, however, harmful interactions can occur.

Cultural beliefs and practices affect not only the biological risk factors for disease but also the existential and experiential meaning of particular diseases. How individuals weigh the costs and benefits of screening, early detection, treatment, and rehabilitation are culturally as well as individually determined. Therefore, incorporating an assessment of the meaning of the disease as well as risky behavior into the study of ethnic differences in incidence and mortality rates would provide more accurate information on the cultural meaning of the disease to the patient and family, which, in turn, would affect each stage of health care, such as decisions to seek care, their choice of treatments, and degree of adherence to treatment protocols. Thus, the source of within- and between-group differences may be more apparent if the effects of cultural beliefs, values, and practices along the continuum of care were identified. Cultural differences in communication etiquette between practitioners and patients and families also affects

their sense of trust and safety, and, subsequently, their health care decisions and actions (Kagawa-Singer & Chung, 2002).

Recognition of the unique needs of the heterogeneous groups within the AAPI population will enable researchers and clinicians to more accurately address the health needs of this cultural group.

—Marjorie Kagawa-Singer

See also ACCULTURATION AND HEALTH; AFRICAN AMERICAN HEALTH AND BEHAVIOR; CULTURAL FACTORS AND HEALTH; HEALTH DISPARITIES; LATINO HEALTH AND BEHAVIOR

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## ASTHMA: BEHAVIORAL TREATMENT

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Asthma is a chronic respiratory disease that is marked by intermittent and variable periods of breathing difficulty. Individuals with asthma demonstrate hypersensitivity to a range of triggers (e.g., allergens, pollutants, infections, stress) that results in swelling, obstruction, and mucus in the airways. Typical symptoms involve wheezing, shortness of breath, chest tightness, and coughing. In recent years, the prevalence, morbidity, and mortality associated with asthma have increased substantially. This rise has been particularly pronounced among ethnic minorities, inner-city communities, and low-income populations. Despite considerable medical advances that have improved the understanding of asthma and enhanced the ability to effectively treat this chronic condition, asthma remains a leading cause of health care utilization and costs.

One explanation for the persistent morbidity associated with asthma involves the behavioral challenges inherent in effectively managing the chronic condition. For instance, widespread nonadherence to asthma medications has been documented among adult and pediatric patients, with patients taking, on average, only about half of their regularly prescribed medications.

Effective asthma management typically requires a combined approach that integrates behavioral strategies (e.g., symptom monitoring) within the context of medical treatment. An integrated approach incorporates three basic behavioral recommendations. First, avoiding triggers is emphasized in order to prevent symptoms and limit the severity of asthma episodes. Avoiding triggers includes staying away from irritants (e.g., tobacco smoke, cold dry air) and allergens (e.g., animal dander, dust, mold). Second, given that medical treatment often involves use of multiple medications over time, treatment plans should be constructed to maximize patient adherence. Prescribing medications that are more convenient to use, require less frequent dosing, and have minimal side effects is more likely to facilitate adherence. Third, ongoing symptom monitoring through the use of a peak flow meter, symptom records, and regular feedback to a physician is critical to determine if adjustments in treatment approach are necessary. An additional component of symptom monitoring involves seeking appropriate health care services (e.g., physician "sick visit," emergency department visit) if indicated.

When children and adults continue to have difficulty with asthma despite an integrated approach, supplemental psychosocial interventions are often recommended. Specialized behavioral interventions have been applied to assist patients with poorly managed asthma, and include educational efforts, cognitive-behavioral therapy, and family therapy to supplement medical interventions.

Providing asthma education as a route to promoting appropriate management behaviors is the most common strategy. Results from studies examining the effectiveness of asthma education have been mixed. A meta-analysis of asthma education programs for children concluded that these programs had limited effects on morbidity (Bernard-Bonnin, Stachenko, Bonnin, Charette, & Rousseau, 1995). Helping patients to better understand their disease and the importance of effective asthma management appears to be a valuable stepping-stone, but educational

efforts in the absence of behavioral strategies typically do not result in sustainable improvements in morbidity and adherence. As a result, intervention efforts that combine education with behavioral techniques, such as cognitive-behavioral skills, stress management, and family therapy, are the most promising approaches.

Cognitive-behavioral interventions include a range of strategies aimed to maximize the frequency and effectiveness of self-management behaviors, such as medication adherence and trigger avoidance. Problem-solving therapy has been identified as a tool that can be used effectively by children, families, and adults to identify barriers to mismanagement (e.g., forgetting to take medications) and adopt strategies to circumvent barriers (e.g., using a daily calendar to monitor medication use). Cognitive-behavioral techniques can also be used to help patients recognize early signs of breathing difficulty and respond appropriately according to a predetermined action plan. As emotions have been shown to trigger asthma exacerbations for a portion of individuals, specific techniques to decrease anxiety and tension, such as relaxation training and biofeedback, have also been investigated. Generally, these programs have been found to be useful adjuncts in improving pulmonary function for individuals who have emotionally triggered asthma. Their efficacy to prevent asthma episodes, however, has not been demonstrated.

Family therapy has also been posed as an adjunct to asthma treatment, particularly in pediatric populations. The emphasis on family therapy is based on the theory that maladaptive patterns of family functioning influence asthma outcomes. Although intuitively appealing, family therapy approaches have not been tested rigorously, so it remains difficult to determine their efficacy.

Behavioral approaches to asthma management have become an integral part of the standard of care. The importance of combining behavioral aspects of care, such as asthma knowledge and self-management skills, with medical management has been documented in the literature and is evident in clinical practice. Behavioral intervention protocols may also be used as adjunctive treatment with particularly challenging cases. Identifying patients in need of adjunctive treatment beyond basic behavioral approaches, such as cognitive-behavioral treatment to promote adherence, is another role of behavioral medicine in the area of asthma. Promoting the integration of behavioral and medical management, identifying

patients in need of adjunctive treatment, and selecting the treatment that best fits the identified psychosocial issue will likely yield the best clinical outcomes.

—Elizabeth L. McQuaid and  
Natalie Walders

See also ASTHMA AND STRESS

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## ASTHMA AND STRESS

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Although consensus has emerged from the clinical, social science, psychological, and biological literature that psychosocial factors affect asthma morbidity, their role in the asthma remains controversial since mechanisms are not well understood. This entry highlights significant insights into this field from a multidisciplinary perspective rather than being an exhaustive overview of the subject. Behavioral, neural, and immunologic pathways are examined, underscoring reciprocal relations that might link psychological factors to both the onset of asthma and exacerbation of established disease.

### HISTORICAL PERSPECTIVE

Early references to the importance of emotional and psychological processes were put forth in a treatise

on asthma by Maimonides, an influential medieval rabbi, philosopher, and physician. Sir William Osler referred to asthma as “a neurotic affection” in his medical textbook, which served as a cornerstone of medical teaching in the latter part of the 19th century. Indeed, before we understood the inflammatory basis of asthma, it was among the disorders believed to be “purely” psychogenic in origin and was commonly referred to as *asthma nervosa*.

Early research in this area was strongly dominated by psychoanalytic theory, an extension of the Freudian idea that symptoms were a symbolic expression of unconscious conflicts and repressed desires. The so-called specific emotion theory was developed in large part by Alexander and colleagues at the Chicago Institute of Psychoanalysis beginning in the 1930s. Concurrently, learning theorists argued that particular emotional experiences may have reinforced pulmonary physiologic responses, thus increasing the likelihood of their recurring in the same context. Eventually, purely psychoanalytic and behavioral formulations gave way to physiological studies providing more objective support for the idea that emotions play an important role in asthma. Stress and psychological factors have been associated with asthma symptomatology and with bronchoconstriction and reduction in pulmonary flow rates.

To explore potential mechanisms linking stress and asthma, it is helpful first to consider how stressors may influence disease in general and second to frame these hypotheses within the current asthma paradigm.

### LIFE STRESS MODEL

When faced with environmental demands, individuals appraise whether the event is threatening or potentially overwhelming to their existing coping resources. If environmental demands are found to be taxing or threatening, and coping resources are viewed to be inadequate, we perceive ourselves as being under stress. This perception is presumed to result in negative emotional states including fear, anger, anxiety, and depression. Changes in behavioral and emotional states that accompany the perception of, and adaptation to, environmental circumstances are accompanied by complex patterns of neuroendocrine and immunologic changes.

### CURRENT ASTHMA PARADIGM

Asthma and allergic disease are understood to be chronic inflammatory processes regulated through

immune phenomena in which many cells (i.e., mast cells, eosinophils, and T lymphocytes) and associated cytokines play a role. Evidence supports the role of complex neural mechanisms and alterations of autonomic nervous system control in the pathophysiology and symptomatology of asthma. Hormones and neuropeptides released into the circulation when individuals experience stress are also thought to be involved in regulating both inflammatory and airway responses. Furthermore, self-management of disease is a cornerstone of current asthma guidelines. Poor self-management has been linked to poor asthma outcomes. Factors important to adherence include asthma knowledge, skills, and management behavior. In addition, these variables are known to be affected by mental health, social support, and personal health beliefs and behaviors.

To simplify the discussion, the relations between stress, psychological dysfunction, endocrine/neural/immune function, social connectedness, and behavior will be reviewed separately in order to explore the influence of stress on asthma. It should be understood that this is a rudimentary approach, as contemporary attempts to apply the biopsychosocial model to disease emphasize that a unidirectional model is too simplistic; causality is at least bidirectional or reciprocal and more probably cyclic in complexity.

## PSYCHOLOGICAL STRESS AND THE ENDOCRINE SYSTEM

Psychological stressors have been associated with the activation of the sympathetic and adrenomedullary system and the hypothalamic-pituitary-adrenocortical (HPA) axis. These systems respond to psychological stress with increased output of adrenaline (epinephrine) and noradrenaline (norepinephrine) from the adrenal medulla. The hypothalamus produces corticotropin-releasing hormone (CRH), which triggers the anterior pituitary gland to secrete adrenocorticotrophic hormone (ACTH), which, in turn, activates the adrenal cortex to secrete corticosteroids. Recent work suggests that negative emotional responses disturb the regulation of the HPA system. Shifts in the circadian rhythm of cortisol have also been found among persons in stressful situations. Other regulatory pituitary (i.e., corticotropin) and hypothalamic hormones (i.e., CRH and arginine vasopressin) of the HPA axis have systemic immunopotentiating and proinflammatory effects. Alterations in a range of

other hormones, neurotransmitters, and neuropeptides (growth hormone, prolactin, natural opiate beta-endorphins and enkephalins) found in response to stress may also play a part in the health effects of stress. Histamine, which is produced by mast cells, may suppress cellular immune function and potentiate a Th2 shift in humoral immune function.

## PSYCHOLOGICAL DISTRESS AND ASTHMA

Asthmatic subjects frequently have associated underlying psychological distress (depression and anxiety). Development of psychological distress in children has been associated with asthma that is more difficult to manage, requiring higher doses of steroids, more frequent and prolonged hospitalizations, and greater functional disability. Asthmatics with comorbid psychological symptoms are more often noncompliant. Psychological morbidity has been linked to asthmatic mortality. Asthmatic subjects have been characterized by beta-adrenergic hyporesponsiveness and alpha-adrenergic and cholinergic hyperresponsiveness. Defects in the function of the autonomic nervous system have also been demonstrated in psychological states. In depression and posttraumatic stress disorder, studies of central mediators in the brain also demonstrate parasympathetic hyperresponsiveness and beta-adrenergic hyporesponsiveness. Increased alpha-adrenergic and cholinergic responsiveness distal from the airway has also been demonstrated in asthmatic patients, raising the question of common biological pathways.

## STRESS AND AUTONOMIC CONTROL OF AIRWAYS

The argument that psychological stress influences autonomic control of the airways is based primarily on the fact that many of the same autonomic mechanisms thought to play a role in asthma are involved in the activation and regulation of physiological responses to stress. These mechanisms include the release of sympathetic nervous system mediators and the action of adrenergic (sympathetic) and cholinergic (parasympathetic) nerves and the neurotransmitters and neuropeptides they produce. Recent experimental studies in which asthmatic patients are exposed to stressful situations have focused on stress-induced vagal reactivity as a mediator of emotionally induced bronchoconstriction. Although human airway smooth

muscle is not functionally innervated by adrenergic axons, studies have shown adrenergic innervation of submucosal glands, bronchial blood vessels, and airway ganglia. The regulatory effects of adrenaline and noradrenaline on adrenoceptors suggest a plausible mechanism by which stress-induced activation of the sympathetic nervous system might influence bronchomotor tone.

It seems paradoxical that activation of the sympathetic nervous system by stress, resulting in release of mediators with a beta agonist effect, should relax airway smooth muscle, and that acute psychological stress, which is accompanied by a rapid increase in circulating catecholamines, should consequently cause bronchodilation. However, the stress-induced response of the autonomic nervous system is more complex and variable. The relative strength of sympathetic versus parasympathetic control in response to certain forms of stress differs with the individual, with some showing a predominantly parasympathetic response. Such individuals may be particularly susceptible to stress-induced bronchoconstriction.

## STRESS AND IMMUNE FUNCTION

A substantial literature exists that demonstrates that psychological stress can influence cell trafficking, cell function including mitogen-stimulated blastogenesis and natural killer cell cytotoxicity, and lymphocyte production of cytokines. Stress can modulate immune response through nerve pathways connecting the autonomic nervous and immune systems, by triggering the release of hormones and neuropeptides that interact with immune cells, and through the impact on behaviors such as smoking and drinking alcohol that are adopted as ways of coping with stress.

Stress is not expected to have the same effects on immune function in all people. As noted earlier, individual differences in response to stressful events are attributable to interpretation of the event, access to coping resources, and presence of antecedent chronic stress. However, there is also evidence of stable individual differences in immune response that occur independent of psychological response to the stressor. When exposed to multiple acute laboratory stressors over time, some subjects consistently demonstrate stress-elicited alterations in immunity, while others do not. Factors (like stress) that stimulate the immune system at critical periods during development may be important in inducing functional changes in neural,

immune, and endocrine components that affect one's perception of and response to subsequent stimuli. For most children who become allergic or asthmatic, the polarization of their immune system into an atopic phenotype probably occurs during early childhood. It has been speculated that stress triggers hormones in the early months of life, which may influence Th-2 cell predominance, perhaps through a direct influence of stress hormones on the production of cytokines that are thought to modulate the direction of differentiation.

## STRESS AND INFECTION

Psychological stress may influence the pathophysiology of asthma by increasing the risk of respiratory infections. The role of respiratory tract infection in asthma is fairly well characterized with current evidence indicating that viral, as opposed to bacterial, infections are the most important infectious agents. A number of mechanisms may be involved. First, viral respiratory infections damage the airway epithelium, causing inflammation. Another mechanism involves the stimulation of virus-specific IgE antibody. Respiratory syncytial and parainfluenza viruses may potentiate the allergic response to allergens by increasing the release of inflammatory mediators from mast cells and the subsequent cascade of inflammatory events characteristic of asthma. Last, viral respiratory infections may also result in the appearance of a late asthmatic response to inhaled antigen. Thus, there is evidence that viral infections are an "adjuvant" to the inflammatory response and promote the development of airway injury by enhancing airway inflammation.

A potential consequence of stress-induced changes in immune response is suppression of host resistance to infectious agents, particularly agents that cause upper respiratory disease. The primary evidence for such effects comes from studies of psychological stress as a risk factor for respiratory infections. Increased incidence of upper respiratory infections under stress in these epidemiological studies may be attributable either to stress-induced increases in exposure to infectious agents or to stress-induced changes in host resistance. Control for exposure is provided by studies in which volunteers are intentionally exposed to a virus—that is, viral-challenge trials. Using this paradigm, psychological stress has been associated with the incidence of infection and illness, with increasing stress related in a dose response manner to increasing risk of infection.

## PSYCHOLOGICAL STRESS AND OXIDATIVE STRESS

A recent hypothesis put forth by Spiteri and colleagues postulates that the inability to detoxify reactive oxygen species (ROS) among atopic subjects then leads to prolonged inflammation, the release of chemotactic factors, the activation and recruitment of immune effector cells, and the stimulation of bronchoconstricting mechanisms. Bronchoconstriction can be triggered by the upregulation of bronchoconstriction eicosanoids. Clinically, atopic subjects either unable to detoxify ROS or overwhelmed by a chronic elevated burden of ROS may develop the onset or aggravation of respiratory symptoms. In way of extending Spiteri and colleagues' hypothesis, one may posit that factors that may predispose susceptible subjects to asthma are chronic exposure to oxidative toxins (tobacco smoke, air pollution) and other *environmental* factors that may augment oxidative toxicity and increase airway inflammation, including psychological stress.

## STRESS AND SOCIAL CONNECTEDNESS

Ecological views on health promotion underscore the significance of the social context within which individuals live and the importance of social relationships. Lack of social relationships has been linked to an array of adverse health outcomes and physiological effects including altered immunologic functioning. Social support may reduce or buffer the deleterious effects of stress by altering the perception of a situation or facilitating more appropriate coping. Greater social network diversity has been related to less anxiety, depression, and nonspecific psychological distress. Social supports may operate through influence on health-promoting behaviors such as abstaining from cigarette smoking, moderating alcohol consumption, improving diet, exercise, and sleep quality. Social support/networks may also buffer direct effects of stress on biological functioning and thus have an impact on asthma.

## ENVIRONMENTAL STRESS AND HEALTH BEHAVIORS

Because self-management is so critical in asthma care, it is important to consider how stress may affect self-management strategies and adherence to prescribed treatment plans. Social learning theory provides a

useful model that examines the interaction among individuals, environments, and health behaviors. Perceived control has been identified among factors that mediate the experience of chronic illness. Interactions between individuals and the environment are key to development of perceived control. Individuals repeatedly exposed to aversive events they cannot predict or control—for example, poverty, adverse life events, living in an unsafe or unpredictable environment—may learn to become helpless. Lack of perceived control may undermine symptom perception and disease management efforts.

## LIFE STRESS, SOCIOECONOMIC STATUS, AND RACE

In the United States, asthma morbidity disproportionately affects poor, urban minority populations. Efforts to identify factors related to these disparities are needed. The adverse association between poverty and ethnic minority status and asthma outcomes may in part be due to differential exposure to and perception of life stress as has been postulated for other health outcomes. Given the renewed interest in the influence of psychological stress on asthma, this is a useful way to conceptualize community-level influences on health whether one operationalizes the environment as a social or a physical construct. Both physical and social factors can be a source of environmental demands that contribute to stress experienced by populations living in a particular area. Various sociodemographic characteristics (e.g., lower social class, ethnic minority status, gender) may predispose individuals to particular pervasive forms of chronic life stress, which, in turn, may be significantly influenced by the characteristics of the communities in which they live. Future studies need to examine the links among these social influences (and the heightened stress that they may elicit) as risk factors for childhood asthma analogous to physical environmental exposures (e.g., allergens, tobacco smoke, air pollution). Such studies are likely to further our understanding of the increased asthma burden on populations of children living in poverty in urban areas or other disadvantaged communities.

## SUMMARY

Stress is multifactorial exposure and may have properties beyond oxidation that can ultimately lead

to asthma. Environmental stressors may affect asthma through neuroimmunologic mechanisms that are adversely impacted and/or buffered by social networks, social support, and psychological functioning. In addition, life stress may affect health beliefs and behaviors that may affect asthma management. Whereas earlier psychosomatic models have supported a role for psychological stress in contributing to variable asthma morbidity among those with existing disease, a growing appreciation of the interactions between behavioral, neural, endocrine, and immune processes suggests a role for these psychosocial factors in the genesis of asthma as well.

While a causal link between stress and asthma has not been established, this entry provides a framework in which we can begin to see links between these systems that might provide new insights to guide future explorations. The complexity of these interactions underscores the need for a multidisciplinary approach that combines the idea that the origin of asthma is purely psychogenic in nature with the antithetical consideration that the biological aspects are all important. These distinctions are artificial, and future research that synthesizes biological, psychological, sociocultural, and family parameters is urgently needed to further our understanding of the rising burden of asthma.

—Rosalind J. Wright

See also ASTHMA: BEHAVIORAL TREATMENT

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## AUTOIMMUNE DISEASES: PSYCHOSOCIAL ASPECTS

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Autoimmune diseases result when the immune system becomes dysregulated and directs its attack not toward foreign invaders, but toward one or more aspects of the body's own healthy organ systems. The consequences of this dysregulation range from relatively mild manifestations, such as hay fever, to life-threatening illnesses. More than 80 serious chronic autoimmune illnesses have been identified, including diseases that involve the skin and connective tissues (e.g., rheumatoid arthritis [RA]), and the endocrine (Grave's disease), nervous (e.g., multiple sclerosis), and gastrointestinal (e.g., inflammatory bowel disease) systems. The underlying causes of autoimmune diseases are still under investigation, but several prevalence patterns provide clues about factors that may contribute to their development. Because autoimmune diseases cluster in families, for example, these illnesses are thought to have a genetic component. In addition, autoimmune diseases are about 3 times as likely to occur among women compared to men, and are particularly prevalent during childbearing years, suggesting that reproductive hormones may play a role. It is important to keep in mind as well that different biological mechanisms underlie each autoimmune condition.

Although immune system activity is a key factor in progression of autoimmune disease, adaptation involves a complex interplay of biological, psychological, and social factors. Not only do the symptoms and physiological underpinnings of autoimmune disease have consequences for psychological and social functioning, but also psychological and social factors influence immune activation and suppression, to affect how individuals respond to their disease in mind and body.



Among the most widely studied psychosocial factors is social stress, which has been associated with dysregulation of immune factors known to influence the course of autoimmune disease. Although stressful events were initially studied for their role in suppression of immune function, more recent studies have found evidence that stress may also activate aspects of the immune system, especially proinflammatory processes. For example, Zautra, Smith, and Yocum (2002) have found greater T-cell activation as well as increased pain among RA patients following a stressful week, with proinflammatory cytokines such as interleukin-6 implicated. Mohr et al. (2000) found evidence of new brain lesions in multiple sclerosis patients following conflict and disruption in routine. Stress-related changes in the hypothalamic-pituitary-adrenal (HPA) system have well-established effects on immune functioning. Elevations in cortisol, for example, suppress immune function, and Sternberg and colleagues have offered the hypothesis that some autoimmune conditions such as RA are a consequence of an insufficient cortisol response. Other stress-related hormones are likely to be involved as well. Moderate increases in prolactin promote immune activation. This pituitary hormone is often elevated during stress and has been found higher in RA than osteoarthritis patients with comparable pain. Although the focus of most studies has typically been on the HPA system, there is also evidence of sympathetic nervous system involvement.

Chronically stressful situations may also reduce the sensitivity of the receptors on immune cells to the anti-inflammatory actions of hormones like cortisol. Coping responses that fail to resolve the stressful situation may lead to chronic distress with accompanying feelings of helplessness and depression. Persons with clinical depression have elevations in proinflammatory cytokines such as IL-6, which are also elevated in some autoimmune conditions such as RA, suggesting that affective disturbance is a key cofactor in disease course (Maes, Song, Lin, et al., 1998). These influences may be reversible through interventions that elevate positive affect and provide means to better regulate negative emotions. Early evidence of such relationships has been found in studies that manipulated positive emotion and found a reduction in levels of proinflammatory cytokines. It is important to keep in mind, however, that models of unidirectional cause and effect relationships often must give way to bidirectional relationships to fully capture the processes

that underlie relationships between immune function and human emotion.

Social networks may be a source of strength as well as a source of stress. There is empirical evidence that patients with an autoimmune disease with good versus poor support systems show less active disease and functional impairment over time. Other researchers have also offered evidence that social ties are health promoting, and there are many pathways through which these associations may be traced: greater motivation to engage in healthy behaviors, quicker recovery from psychological distress following stressful events, and more resilient physiological responses following an adaptation challenge.

One outgrowth of the acknowledgment that psychological, social, and physiological processes contribute to autoimmune conditions is the development of psychosocial interventions. Among the most common forms of treatment is cognitive-behavioral therapy (CBT), which typically targets improvement of aspects of health status, such as pain tolerance, mobility, self-management, and self-efficacy. CBT may include training in progressive relaxation, rational thinking, active coping skills, goal setting, and stress management. It is not intended to replace more biomedically oriented approaches, but rather to complement the standard biological treatments offered to patients. Evidence to date suggests that CBT is an efficacious treatment, resulting in decreased pain, depression, disease activity, and health care utilization among patients with autoimmune disorders.

More recently, studies have yielded findings that suggest that increasing the opportunity for emotional expression may have beneficial effects for those with autoimmune disorders. In one study, RA patients were randomly assigned either to talk privately about a stressful event or to discuss a trivial topic for 15 minutes on 4 consecutive days. Patients who discussed a stressor had less physical dysfunction and less affective disturbance at the 3-month follow-up than did those who discussed a trivial event. There were no differences in pain or joint condition, however. Another investigation used a similar paradigm and found that at 4-month follow-up, RA patients who wrote about traumatic events showed improved health status and less disease activity than did those who wrote about their daily plans. These findings suggest that a focus on emotional disclosure may yield significant benefits, at least among RA patients, and highlight the potential of emotional processes as an important

target in psychological interventions for patients with autoimmune disease.

Interventions that center on reinforcing social support among patients with autoimmune disease have yielded less promising results. For example, supportive-expressive group therapy (SEG) did not improve levels of distress and other symptoms in systemic lupus erythematosus patients over and above the effects of usual care at 12 month follow-up. Among multiple sclerosis patients with major depressive disorder, patients treated with either CBT or antidepressants showed greater reductions in depressive symptoms compared to those treated with an SEG intervention at 12-month follow-up. In another study, the addition of a family support component did not enhance the efficacy of a CBT intervention designed to control RA symptoms. Both CBT alone and CBT with support interventions showed significant improvement in joint pain and swelling relative to a no-treatment control. Whether supportive interventions alleviate symptoms and enhance functioning among autoimmune patients remains an open question.

Although CBT and other psychosocial treatments have generally produced significant clinical benefits, the mechanisms by which these benefits accrue have remained largely unexplored. In particular, relatively little is known about the impact of psychosocial interventions on immune function or stress-responsive hormones. One exception is the work of Mohr and colleagues (Mohr, Goodkin, Islar, Hauser, & Genain, 2001), who examined the relationship between levels of a proinflammatory cytokine, interferon (INF)-gamma, and depression symptoms among depressed multiple sclerosis patients. Depressive symptoms were positively related to INF-gamma production prior to treatment, and both INF-gamma and depressive symptoms decreased in response to treatment. This study needs to be replicated and the findings tested to see if they would apply to other autoimmune conditions. Nevertheless, they suggest that treatment of depression may affect levels of proinflammatory components of the immune system, and may therefore provide both symptom alleviation as well as a novel disease-modifying therapeutic strategy for patients with multiple sclerosis, and perhaps those with other autoimmune disorders.

Autoimmune diseases offer a window into mind-body relations that is inviting to both basic scientists and also clinical health researchers. In these conditions, the psychosocial variables affect biological as well as behavioral substrates that underlie the signs

and symptoms of disease. The interdisciplinary issues are daunting, to be sure, but the promise is great for those biobehavioral researchers with a high tolerance for ambiguity and who can openly engage with scientists outside their own disciplines.

—Mary C. Davis and Alex J. Zautra

See also PSYCHONEUROIMMUNOLOGY

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## BEHAVIORAL GENETICS AND HEALTH

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Behavioral genetics (also known as quantitative genetics) involves the examination of a wide range of factors for scientific investigation. The “behavior” in behavioral genetics is not limited to those studied by social scientists. From social behaviors such as attachment to psychological variables such as intelligence to health variables such as blood pressure, behavioral genetics approaches have been applied.

Behavioral genetics originally became a field of inquiry, in part, in opposition to the developmental “environmentalist” view that only factors from the environment are involved in interindividual variability in the development of children. Just as erroneous a view is that genes are the most important factors involved in interindividual differences. Recent advances in molecular genetics techniques have significantly increased our ability to understand the contribution of genes to health and illness. However, the inclination to believe that genes account for all or none of the differences between people is “genetic determinism” and does not accurately represent the assumptions of behavioral genetics methodologies. For example, some suggest that disease processes arise from early environment. If the prenatal environment does affect diseases such as Type 2 diabetes or hypertension and identical twins are highly concordant for these conditions, genetic explanations are not the only viable interpretations. It may be due to adverse environments in the womb.

One of the potential dangers in emphasizing the presence of genetic influences and ignoring environmental factors is that society and policymakers will invest less in changing environments. One must keep in mind that behavioral genetics methods operate under assumptions of the collective contribution of genes *and* environment, *not* nature *versus* nurture. So the interventions to improve health will be most effective when combinations of environmental manipulations and gene therapies (when appropriate) are developed. This entry presents a brief introduction to behavioral genetics methodology and then a brief review of some research from the past 15 years using this approach.

### GENERAL BEHAVIORAL GENETICS METHODS

Traditionally, behavioral scientists and epidemiologists have tended to attribute behavioral variation only to environmental sources. During the past decade, however, most researchers have come to accept the notion that genetic factors are, in part, responsible for individual variation on many measures of behaviors. Using a behavioral genetics approach, origins of individual differences are conceptualized to derive from additive genetic and environmental sources of variance and thus, in theory, account for the total behavioral or phenotypic variation (phenotypic variation refers to the pattern of scores that results from studying the behavior of interest).

Additive genetic variation is the sum of the effects from genes influencing a trait. In some disease processes such as phenylketonuria or Huntington’s

chorea, single genes have been found to be responsible in the formation of the disease states. These examples of one-gene, one-disease (OGOD) scenarios are typically not the case for most behavioral phenomena nor are they the premise of quantitative genetic analyses. The underlying premise is that multiple genes or pleiotropy is involved in genetic effects that are observed in a trait.

Although the name *behavioral genetics* (sometimes used in place of quantitative genetics) implies an emphasis on heritable aspects of behavior, the identification of environmental influences on a phenotype is equally important in this type of analysis. Environmental effects are partitioned into those that are common (shared) or unique (nonshared). Common/shared environmental variation is the phenotypic variation due to the subjects living in the same family, thus sharing the same environment.

Unique/nonshared environmental variation is the component of phenotypic variance that can be attributed to the environmental factors not shared by family members and thus making members of the same family different from one another. One hypothesis posed about the outcome of such studies on older populations is that as individuals age, unique environmental factors will have a greater impact on the etiology of behavioral traits. This idea is derived from the speculation that as a person ages, he or she has a greater number of experiences that help to shape the behavioral trait of interest. It is, of course, hazardous to operate on speculation and conjecture rather than scientific data, and there is evidence that this scenario is not the case with several phenotypes in older individuals, such as cognitive abilities.

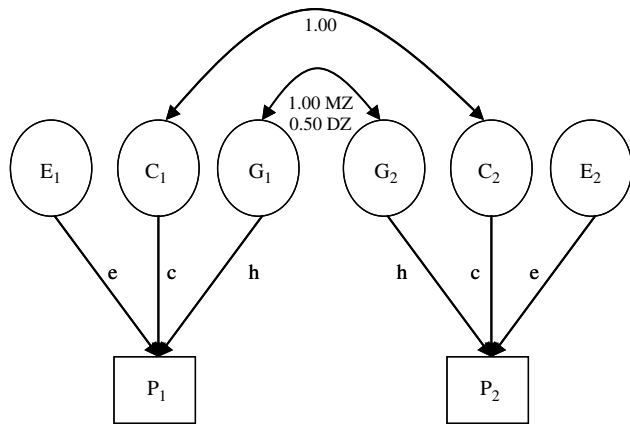
Behavioral genetics designs frequently take the form of twin studies. The classic twin study involves comparisons between identical or monozygotic (MZ) and same-sex fraternal or dizygotic (DZ) twin pairs (twin pairs that are genetically as alike as siblings but are born at the same time). There are several variations of this design but the classic twin study tends to be the most frequently used design. An assumption of behavioral genetics is that MZ twin pairs share 100% of their genes (DZ twin pairs share on average 50%). Using data from twin pairs and operating under this assumption, the heritability of a trait can be analyzed using several techniques. Heritability is considered the proportion of phenotypic variance that is due to genetic variation. A popular simple method for calculating heritability is to calculate twice the difference between

the intraclass correlations (the statistical calculation of how similar one twin is to the other) of MZ and DZ twin pairs. Shared environmental variance can be calculated by doubling the intraclass correlation for the DZ twin pairs and subtracting the MZ intraclass correlation. By subtracting the sum of the heritability and shared environmental estimates from 1.00, an estimate of nonshared environmental variance is obtained.

As in other social sciences fields, structural equation modeling (SEM) or biometrical modeling, the fitting of observed data to models of genetic and environmental effects, is the preferred method of behavioral geneticists to analyze data. These SEM techniques provide estimates that represent the relative contribution of genetic and environmental influences. Variances and covariances are used in the calculation of the components of variance (genetic, shared environmental, and unique environmental). The benefit of these techniques over the intraclass correlation method described earlier is that multivariate extensions can be performed to simultaneously assess shared and unique genetic and environmental relationships among two or more variables.

An example of a path diagram of a classic univariate twin model is shown in Figure 1. Path diagrams are useful in that they provide a visual display of correlational and causal relationships between variables. By employing path analysis, specific hypotheses about relationships between the variables are quantified by parameter estimates or path coefficients. In the model shown in Figure 1, the overall phenotypic variance is explained using three components: G-additive genetic variation, C-common or shared family environmental variation, and E-unique environmental variation. In Figure 1, G, C, and E are latent (unmeasured or unobserved) variables, and  $h$ ,  $c$ , and  $e$  are parameter estimates. In this figure,  $P_1$  represents the observed score for Twin 1 and  $P_2$  represents the score for Twin 2. It should be noted that the example provided here is the general example and that P could represent any phenotype, trait, or variable.

In model fitting, observed data are compared to expected values and the result is a familiar  $\chi^2$  statistic. Using these techniques, parameters are dropped from the model to see if a more parsimonious model (one with fewer parameters or latent variables, yet still fitting the data) is available to explain the data. Statistical significance of these parameters is assessed from maximum likelihood ratio  $\chi^2$  comparisons of the models after the parameters have been dropped.



**Figure 1** Structural Equation Model of Genetic and Environmental Influences

NOTE: G represents the additive genetic influences, C represents the shared environmental influences, and E represents the non-shared environmental influences. The h, c, and e represent the parameter estimates for each of the constructs.

Significance of parameters is evaluated by taking the difference between the  $\chi^2$ s of the full and reduced model and using that difference as a  $\chi^2$ . The degrees of freedom are calculated by taking the difference between the degrees of freedom for the full and reduced models. If there is a significant difference between two models, the parameter that was dropped is significant.

Using this basic model, then, if MZ twins are more alike than DZ twins, phenotypic variance can be attributed, in part, to genetic sources. If the genetic variation estimated by the parameter h represents a significant source of variation, this parameter cannot be dropped from the model without causing a significant change in  $\chi^2$  between the models. Squaring that parameter, h, provides an estimate of heritability. The contribution of shared and unique environmental factors to the phenotypic variation is also tested in this manner. For ease of comprehension, parameter estimates are typically standardized.

## BEHAVIORAL GENETICS STUDIES OF HEALTH

Perhaps now more than ever, health researchers acknowledge that behavior is a central underpinning of many chronic illnesses and diseases. There is great utility, then, in understanding the contribution of genetic and environmental influences in understanding behaviors associated with health. This information

may have the capacity to be the framework for public health guidelines developed to lower the incidence of chronic health conditions. Behavioral genetics methodology has been used to study many aspects of health for disease processes such as cardiovascular disease, cancer, and diabetes and risk factors for these diseases such as obesity, hypertension, and smoking. There is also growing interest in psychosocial measures associated with health such as stress. Below is an overview of the findings from numerous studies.

### Cardiovascular Disease

Heart disease continues to be the leading cause of death in the United States. Classic twin studies document significant genetic influences on cardiovascular stress patterns, and longitudinal studies suggest that heightened reactivity to stress constitutes a risk factor for the development of sustained hypertension.

Previous research on twins suggests that hereditary factors may be important determinants of cardiac dimensions and/or the degree of cardiac adaptability to physical conditioning. For example, small, dense LDL (LDL subclass phenotype B, these are the “bad” form of cholesterol) is a common, genetically influenced risk factor for coronary heart disease (CHD). Twin studies have also shown in higher concordance (twins both have the same phenotype or match) rates for premature CHD in MZ than in DZ twin pairs.

### Cancer

Twin studies of cancer show varying heritability estimates depending on type of cancer under investigation. Estimates of the genetic component for colon/colorectal cancer range from 10% to 35%, 27% to 43% for breast cancer, and 30% to 50% of the plasma fibrinogen. Estimates for lung cancer and melanoma are 14% and 18%, respectively. If assortative mating (people marrying based on a factor that is important to what is being studied, e.g., education) were important for liability to cancer, these heritability estimates may be an underestimation of the true genetic effects. Shared environments were equally important in colorectal cancer and melanoma, whereas no shared environmental effect has been found for lung cancer. The nonshared environmental effect for colorectal cancer, melanoma, and lung cancer is between 67% and 71%. The heritability estimates are much higher than those obtained from

family studies in which parents and offspring, or siblings, are compared.

### Diabetes

There are well-accepted links between genes and diabetes. Support for the notion of genetic influence in the development of NIDDM (non-insulin-dependent diabetes mellitus) has come from twin studies. Much of the recent research has focused on low birth weights of identical diabetic twins and the environment the child experiences in the womb. The shared-placenta MZ twins may experience a more adverse intrauterine environment compared to DZ twins and may therefore be more prone to develop various metabolic abnormalities. Some researchers have gone to the extent of creating models that include chorion type (the way twins are connected to their mother via the placenta) in their statistical modeling.

### Obesity

Obesity is thought to be at or near epidemic levels in this country and significantly contributes to cardiovascular diseases and diabetes. Children of obese parents have a substantially higher risk of adult obesity than children of lean parents, and adoption and twin studies have shown that this risk is largely genetic. Results from twin studies suggest that genetic factors explain 50% to 90% of the variance in body mass index or BMI (this is an index of the distribution of weight relative to a person's height). Studies that involved a combination of twins, adopted offspring, and other family relatives have also demonstrated relatively high heritability (40-70%) of many of the traits involved in obesity. These results are not only evident cross-sectionally but also longitudinally. Classic twin methods have estimated consistently high heritabilities for height, weight, and BMI. One might assume that there are genetic influences on food intake or perhaps even preferences for foods with low nutritional value. However, analysis of the heritability of intake has not shown food or taste preferences to have a strong genetic basis.

### Hypertension and Blood Pressure

Hypertension is associated with chronic and life-threatening illnesses such as CHD, kidney failure, blood vessel damage, and stroke. Estimates of heritability

range from 25% in pedigree studies to 65% in twin studies for sitting diastolic blood pressure.

In general, twin studies have suggested that about 30% of systolic blood pressure variance is attributable to genetic factors and 70% to environmental factors. While pertinent environmental factors such as salt intake, alcohol use, and amount of exercise also correlate significantly among relatives, only 7% of the total variance of diastolic blood pressure seems attributable to all shared environmental factors in family households.

### Smoking

The tremendous costs both at the individual and societal levels associated with tobacco use are well documented. Twin studies suggest that genetic factors influence smoking behavior. The data from family, adoption, and twin studies strongly support a substantial genetic influence on the initiation and maintenance of smoking. The literature supports the following hypothesis of the development of nicotine dependence. Smoking initiation is the obligatory first step. Research on the liability to initiating smoking show genetic influences of approximately 60%, shared and nonshared environmental influences of about 20% each. The impact of shared environment may be particularly pronounced in midadolescence when many begin smoking. A portion of those who initiate smoking go on to nicotine dependence. In this scenario, genetic factors appear to be more prominent, accounting for approximately 70% of the variance and shared environmental influences appear to be negligible. The genetic factors that predispose to smoking initiation appear to overlap substantially but not completely with those for nicotine dependence.

## GENETICS, ENVIRONMENT, AND HEALTH: INTEGRATION OF APPROACHES

The National Human Genome Research Institute (NHGRI) of the National Institutes of Health announced in June 2000 that it had developed a working draft of the human genome. This historic event places science on the doorstep of limitless possibilities including new insights about diseases and how to treat and prevent them. The trepidation about genetic approaches in the study of health by some scientists may arise from the inherent power in identifying biological mechanisms of disease and illness. Knowing

the sequence of the genome, however, is only the beginning. Equally important will be our knowledge of how the environment influences health, disease, and complex behaviors associated with health.

It is a correct assumption that investigations of health differentials across ethnic groups solely on the basis of genetic differences will not yield accurate identification of the mechanisms responsible for health disparities. Preconceived notions about genetically based racial inferiority have hindered advances in understanding and reducing health disparities. Attempting to explain the differential health burden ethnic minorities experience by genetic differences goes against probability given there are considerably small genetic differences across racial groups and more variability within each group.

The role of genetic influences, however, cannot be completely dismissed. The manner in which genes have the potential for playing a role in creating health differentials requires further explanation. It is not genes defining individuals from different ethnic groups that is key to the elucidation of health differentials per se. Instead, describing health differentials as arising from insults to a complex system represented by the interaction between genes and environments that creates excess burden of chronic illness and disease within some groups is a more accurate perspective.

In contrast to simply focusing on genetic explanations, there is ample information that differences in environmental factors between ethnic groups account for disparities in health status. Previous research on the significant impact of combinations of sociodemographic and psychosocial factors in disease processes and complex behaviors is perhaps our best indicator that science must avoid a reductionistic view. Genetic reductionism assumes that knowing and manipulating the genome will cure all our ills. Rather, we must understand how genetic and environmental influences work in concert to account for health conditions and the psychosocial variables that affect health. Much of previous research has focused on the behaviors and social structures that produce differences in health and disease across ethnic groups. One of the future and formidable challenges to using the information ascertained from adding genetic information to examinations of health differentials is to understand the underlying effect genes have on health and aging within complex environments or contexts. We may find that the polymorphisms (an alternate version of

a gene) that occur in genotypes (people's genetic architecture) are destructive or protective factors related to disease and health that are created, modified, or triggered by cultural and contextual factors.

Complementary, interdisciplinary approaches are desperately needed to harness the important findings that will come from the Human Genome Project and continued epidemiological research in the exploration of the underlying causes of health and illness and the related psychosocial behaviors. Continued use of behavioral genetics designs (and modified designs such as those mentioned here) will significantly advance our knowledge. Both conceptual and statistical advances in these methods are still required. These methods have the potential to provide the backdrop for exciting new revelations about how genes and environment work in concert to create health and illness.

—Keith E. Whitfield

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See also GENETIC TESTING: ETHICAL, LEGAL, AND SOCIAL ASPECTS

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## BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM

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The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based system of health surveys. It was established in 1984 by the Centers for Disease Control and Prevention (CDC). Information on health risk behaviors, clinical preventive health practices, and health care access, primarily related to chronic disease and injury, is obtained from a representative sample of adults in each state. For most states, the BRFSS is the



only source for this type of information. Currently, data are collected monthly in all 50 states, the District of Columbia, and Puerto Rico; annual point-in-time surveys are conducted in the Virgin Islands and Guam. More than 200,000 adult interviews are completed each year, making the BRFSS the largest telephone health survey in the world. Not only is the BRFSS a unique source of risk behavior data for states, but the system is also useful to measure progress toward Healthy People 2010 objectives for the nation.

In behavioral surveillance, the BRFSS has a relatively long history. Beginning in 1984, 15 states initially participated. Data were collected on the six individual-level risk factors associated with the leading causes of premature mortality among adults: cigarette smoking, alcohol use, physical inactivity, diet, hypertension, and safety belt use. From its inception, the BRFSS was designed to allow states to add questions of their own choosing to their individual surveys. By 1993, the BRFSS had become a nationwide system and the total sample size exceeded 100,000. Beginning in 1988, optional, standardized sets of questions on specific topics (optional modules) were made available to states. The survey was redesigned in 1993, with certain questions asked every year (fixed core) and others asked every other year (rotating core). As part of the 1993 redesign, up to five “emerging” core questions for newly arising topics were included each year for all states.

Through the collection of behavioral data at the state level, the BRFSS has proven to be a powerful tool for building health promotion activities. As the demand for data has increased, there has been an increase in the number of requests to add questions to the survey. Currently, almost every division in National Center for Chronic Disease Prevention and Health Promotion and other CDC centers, institutes, and offices have questions on the BRFSS. Interest in the BRFSS has also grown outside of CDC. Other federal agencies, such as the Health Resources and Services Administration, the Administration on Aging, and the Veterans Administration, have added questions to the survey. There have also been requests for technical assistance from other countries that are eager to develop similar surveillance systems. The World Health Organization is developing a model surveillance system based on the BRFSS for export to any country.

For most states, the BRFSS is the only source of population-based health behavior data related to chronic disease. As the system has expanded, so have the

number of optional modules and state-added questions. In 2000, 19 optional modules were selected by states to add to their surveys. These are in addition to the approximately 80 core questions that are asked by all states.

With the growth of the system, some notable successes have been realized. Currently, all states use BRFSS data to establish and track state health objectives, plan health programs, or implement a broad array of disease prevention activities. Nearly two thirds of states use BRFSS data to support health-related legislative efforts. For example, in Delaware data were used to support legislation in publications, public hearings, and legislative sessions. A bill to create the Healthy Lifestyle and Tobacco-Related Disease Prevention Fund successfully passed. Two successful legislative initiatives were supported by data on the prevalence of smoking and mammography screening in Illinois—an act requiring no-smoking areas in public buildings and one requiring the inclusion of mammography screening in all health insurance coverage. In Nevada, BRFSS data documenting the state’s high rates of chronic and binge drinking were used to support legislation to place a per gallon tax at wholesale level on distilled alcohol. Only because the data were state specific could these efforts succeed.

As the usefulness of the BRFSS has increased, there has been a greater demand for more local-level data, that is, data at the district, county, or city level. Although the BRFSS was designed to produce state-level estimates, growth in the sample size has facilitated production of smaller area estimates. The need for prevalence estimates at the local level has led to the Selected Cities Project. Data from the 1997-2000 BRFSS are used to calculate estimates for selected urban areas in the United States with at least 300 respondents. This new use of BRFSS data has yielded estimates for nearly 200 metropolitan areas for the 1997-1999 combined data. The 2000 data provided estimates for 100 metropolitan areas. Preliminary results showed that the prevalence of certain behaviors varied across cities, not unlike the differences found across states. Variation in prevalence was also observed when cities were compared with their surrounding metropolitan areas and with the rest of the State. This new use of BRFSS data fills a critical public health need for local area surveillance data to support targeted program implementation and evaluation; and these data should help cities to better plan and direct their prevention efforts.

In addition to these achievements, there have been numerous analyses of BRFSS data and several published articles and reports, both by CDC and individual states. The majority of articles and reports have received wide dissemination in the literature and other media. State-specific reports have been used by several states for program planning and policy. Data from BRFSS were essential in identifying and tracking the epidemics of obesity and diabetes in the United States.

To facilitate use of BRFSS, data and reports are disseminated through the BRFSS Web site ([www.cdc.gov/brfss](http://www.cdc.gov/brfss)). The challenge for the BRFSS is how to effectively manage an increasingly complex surveillance system, which serves the needs of numerous programs, in the face of changing telecommunication technology, and the greater demand for more local-level data.

—Ali H. Mokdad,  
Camara P. Jones, and David G. Moriarty

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## BEREAVEMENT AND HEALTH

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This entry examines the impact of bereavement throughout the life span as it relates to physical and mental health. A discussion of bereavement events will focus attention on the meaning of these losses through relevant theoretical perspectives and other bereavement-related factors such as gender, mortality, stress, health, and social support.

In general, bereavement is usually followed by a normal but painful adjustment to the loss. The bereavement process may become complicated as symptoms of depression frequently overlap with normal reactions to bereavement such as sleep disturbance, crying, weight loss, concentration difficulties, and anger or aggression. A factor associated with normal bereavement is the preexistence of life stressors that may coincide with the bereavement experience, such as low socioeconomic status, poor physical health, and the unavailability of a confidant. Physical health expressions may include a hollow feeling in the stomach, tightness in the chest and throat, dry mouth, sensitivity to noise, shortness of breath, muscular weakness, and lack of energy. Cognitive expressions may include disbelief, confusion, preoccupation with thoughts of the deceased, and an attempt to put the event into perspective and find meaning and understanding. Affective expressions are recognized as depression,

sorrow, sadness, guilt, anger, relief, and denial. Behavioral reactions may be the result of physical, affective, or cognitive changes and may present as a slowing down of movements or “longer reaction times” (Kalish, 1987, p. 35). In addition, there is the potential for the bereaved individual to develop health problems precipitated by an increase in self-destructive behavior, such as smoking, drinking, or overeating. Individuals may also experience an increased risk for an exacerbation of present health problems, which can lead to sudden death or suicide.

Role changes (following the death of a loved one) are said to represent a link between a major life event and stress. Stress is created directly by the individuals’ need to compensate or readjust to the disruption in their lives, and also indirectly through the increase in multiple roles. Stress can manifest itself in many forms in the human system: endocrine, immunologic, metabolic, cardiovascular, or particular diseases, and it has been associated with symptoms such as pain, depression, strain, fatigue, restlessness, panic, shortness of breath, headache, and tension (Parkes, 1972).

### BEREAVEMENT EVENTS

Depending on the type of loss, an individual may experience the loss as the status of a bereaved child; a bereaved spouse, sibling, or parent; or even a bereaved grandparent or great-grandparent.

#### Death of a Spouse

The strength of the bond with the deceased spouse tends to persist long after the initial year or two following the bereavement event. The death of a spouse may coincide with the physiological changes associated with aging and as a result lead to increased stress and a decline in physical or mental health. This may represent the loss of a sexual partner and companion; changes in decision making regarding household tasks, finances, and relocation; and changes in social roles and lifestyles. Widow(er)s live in a high-risk environment as a sense of hopelessness and helplessness may produce further stress and subsequent health problems or illness. In addition, the supportive nature of the relationship is lost in which reminders or cues are absent for important daily activities. Meaningful relationships from friends and coworkers may be disrupted contributing to an increased sense of social isolation and loneliness, which has been

associated with high rates of suicide, mental disorders, and mortality. Psychological stress has been recognized as a major factor contributing to earlier deaths among widowers due to biochemical changes (Parkes, 1972).

### Death of a Child

Parkes (1972) notes that the death of a child appears to produce greater emotional devastation for mothers than for fathers. Osterweis (1985) discusses the aspect of extreme guilt and anger, which may be experienced by bereaved parents due to the inherent need to prevent or actually save their child from the untimely death. Furthermore, the death of an adult child usually has a devastating and lasting impact on the physical and emotional health of aging parents (Osterweis, 1985). The surviving elderly parents may be forced to assume caretaking or financial responsibilities for the remaining grandchildren. Erikson's theory of generativity or grandgenerativity as a developmental stage of old age can be viewed as a reciprocal relationship from significant other loved ones involving caring and receiving care. A crisis may occur if the developmental sequence is severed when parents outlive their own children or grandchildren.

### Death of a Parent

Kalish (1987) attempts to explore the experience faced by the "older adult as a bereaved child" (p. 35). Parkes (1972) reports that the death of a parent does not produce an increase in health-related illnesses. However, it is not to be assumed that the death of a parent is less painful than other important losses. Residual feelings of guilt, anger, and hostility over unresolved issues may surface following the death of a parent. For some, a parent's death can be a severe blow to physical and mental health and stability.

### Death of a Sibling

As with the loss of a spouse, familial ties and relationships have extended for many years. Despite the level of past and present involvement, "the loss of a sibling, especially a younger sibling, remains a powerful reminder of one's own mortality" (Osterweis, 1985, p. 11). Depending on the level of emotional closeness or the degree of participation in daily activities prior to a sibling's death, feelings of vulnerability

to inheritable diseases and impending mortality are increased (Osterweis, 1985).

### Death of a Friend

Similar themes are present when a close friend dies, such as a decreased coping ability, anger, guilt, anniversary syndrome, visions of the deceased, and economic, legal, and health consequences. Doka's (1989) research on disenfranchised grief pays particular attention to the "friend as griever" experience (p. 77). He defines disenfranchised grief as "the grief that people experience when they incur a loss that is not or cannot be openly acknowledged, publicly mourned, or socially supported" (p. 4). Compared to the death of family members, the death of a friend is a powerful predictor and places the individual at an even greater risk for developing health problems. The frequency of lost friendships is similarly described by Kemeny et al. (1994) in the repeated bereavement situations among the HIV and gay community of men who have lost several close friends or lovers.

## MORTALITY AND GENDER

Widowers have higher mortality and suicide rates than widows (Stroebe & Stroebe, 1983) and appear to experience higher levels of psychological distress than women. Studies show an increase in the death rate among widowers over the age of 54 of almost 40% during the first 6 months of bereavement, indicating that the loss is experienced more severely by widowers than by widows (Parkes, 1972; Stroebe & Stroebe, 1983). According to one report, widowed men, regardless of age, are more susceptible to early death than their married counterparts (Osterweis, 1985). Furthermore, the effects of stress and poor self-care contribute to the high mortality rate among newly bereaved widowers (Gass-Sternas, 1995).

Stroebe and Stroebe (1983) explain gender differences and bereavement outcome in terms of a biological predisposition to specific health problems or diseases in which men and women are differentially susceptible. The evidence supports the notion that there is an interaction between biological, social, and psychological factors. Furthermore, "life events that appear to be harmful for the health of older men tend to be those involving disruption of social networks, i.e., bereavement and relocation" (Aldwin, 1990, p. 56). Aldwin (1990) studied the relationship between

egocentric stress (losses affecting the “self”) and non-egocentric stress (concern for others) on health status among aging male veterans and found that events causing a disruption in relationships such as losses related to bereavement or relocation were the most harmful and stressful events affecting their health.

Rogers and Reich (1988) discuss studies that report an excess in mortality following the first year after the loss of a spouse among widowers and also a higher death rate from physiological vulnerabilities, infectious diseases, accidents, and suicide than among widows. The difference may be reflected in the widow's perception of poorer health. Widowers may develop health problems over a longer period of time and may also tend to underestimate or underreport health difficulties immediately after the loss of their wives.

#### BEREAVEMENT, STRESS, AND SOCIAL SUPPORT

The death of a spouse eliminates the supportive characteristics of the marriage relationship in which roles were validated and assistance was shared among various tasks (Stroebe & Stroebe, 1983). Therefore, married people tend to have less strain than single people of either sex. Furthermore, it would imply that widows have less to lose in terms of roles than widowers due to the general idea that women carry the greater burden in the marriage role as housewife, mother, employed worker, or a volunteer outside the home. On the other hand, men have a greater tendency to remarry than women and are less prone to experience extreme role shifts. Social support, in general, and specifically in the form of various leisure or formal community supports, has been positively associated with psychological well-being and physical health, and in some cases serves as a buffer against the stress of bereavement and makes the experience less detrimental (Fitzpatrick, 1998; Fitzpatrick, Spiro, Kressin, Greene, & Bossé, 2001; Wheaton, 1985).

#### THEORETICAL PERSPECTIVES

Freud's (1917) psychoanalytic theory on mourning and melancholia focuses on the intrapsychic aspects of bereavement with regard to the concept of the libido that is attached or cathected to a lost loved object or person. Melancholia (abnormal or depressive illness) according to Freud results when the loss remains unconscious and the defense mechanism of

repression acts to inhibit these unconscious feelings from one's awareness or consciousness. Lindemann's (1944) theory focuses on acute grief and bereavement reactions addressing reactions to loss situations such as posttraumatic stress syndrome. Their ideas provide a reasonable explanation and understanding of the unconscious attachment mechanism and persistent tendency for the grieving individual to experience ongoing stress as a result of the intense work during the mourning and bereavement experience.

Bowlby (1969), Parkes (1972), and Marris (1978-1979) offer a perspective that combines psychoanalytic thinking and cognitively oriented theories. Bowlby postulates that attachment behavior is a survival mechanism for joining human beings to each other originating in childhood with the initial mother-child interaction. Grief and loss (bereavement) are essentially separation anxiety in which an unwanted separation from the deceased occurs, resulting in anxiety, protesting, and searching behavior. The relationship with the deceased is never completely severed. Furthermore, reactions to loss may be influenced by immunobiological or other stress-related factors depending on the individual and the circumstances. Parkes focuses his attention on cognitive restructuring to explain the bereavement process and employs three models: medical, cognitive, and cathartic. He attempts to explain the process of grief through medical classifications, and believes that the recovery period (cognitive restructuring) following a bereavement event for an individual must include the experience of pain, distress, and impaired functioning before recovery can be attained. Marris moves beyond attachment and instinctual behavior and proposes a cognitive theory of grief, which focuses on approach and avoidance tendencies and information processing in the bereaved as an attempt to restore predictability in one's environment.

Other important theories include the sociobiological perspective, which endeavors to address the aspect of kinship relationships in the grief process by making predictions about gender and age differences among family members (Littlefield & Rushton, 1986).

Ramsay's (1977) theory of grief includes the role of reinforcement, the environment, and situational factors such as social support. This ties in with the model of social support and stress-reduction proposed by Wheaton (1985). The present trend in the theoretical approach to bereavement is to encompass a broad and global psychological stress theory. This perspective may be more in line with specific loss events

(i.e., spouse, child, parent, sibling, friends, or other family members) and could be linked with an increase in stress and physical health problems. (See Fitzpatrick, 1998, for a detailed discussion.)

## SUMMARY

Bereavement represents a stressful life event, and frequently individuals are at a particular health disadvantage as evidenced by findings reporting high rates of psychological and physical disorders, mortality risk, and suicide. A broad theoretical perspective including aspects of psychoanalytic theory, cognitive theory, and sociobehavioral models including concepts of attachment, cognition, the role of kinship relationships, and the stress-reduction process was discussed as a conceptual framework for the study of bereavement, health, and survivors.

This review has practical importance for health care professionals who provide services to individuals and their family members in the community. The literature suggests that for bereaved individuals who have experienced the loss of a loved one, social supports may in fact serve as a buffer against the harmful impact of bereavement and thus reflect on physical and mental health. It is important to foster supportive relationships throughout the life span as the nature of relationships is often subjected to increasing loss of friends and loved family members. Social activities may provide an atmosphere to promote participation in an active lifestyle, thus preventing further health problems, isolation, or other maladaptive and self-destructive behavior. By broadening the definitions of loss, practitioners should identify the varying needs resulting from different types of bereavement events and engage in grief work tailored to specific supports that directly address these needs.

—Tanya R. Fitzpatrick

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## BINGE DRINKING IN COLLEGE STUDENTS

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Heavy drinking is an important factor in more than 100,000 deaths in the United States each year, including

**Table 1** Alcohol-Related Problems Among U.S. College Students

	<i>Students Reporting Problems (in percentages)</i>		
	<i>Non-Binge Drinkers</i>	<i>Occasional Binge Drinkers</i>	<i>Frequent Binge Drinkers</i>
Educational	14	39	68
Psychological	20	46	74
Antisocial	15	35	63
High-risk sex	10	24	44
Drinking and driving	26	52	75

SOURCE: 2001 Harvard School of Public Health College Alcohol Study, <http://www.hsph.harvard.edu/cas/>.

those resulting from motor vehicle crashes, falls, fires, drowning, assaults, homicides, and suicides. In addition, it is associated with a large percentage of non-fatal traumatic injury, thus making heavy alcohol use a major public health issue. Approximately one in five (21%) adults in the United States drank five or more drinks on one or more occasions in the past month, and almost half of all high school students who drank alcohol drank in this fashion. Young people tend to drink more heavily than older adults, and college students tend to drink more heavily than their same-age peers who do not attend college. As a consequence, students enrolled in 4-year colleges comprise one of the heaviest-drinking groups in America.

Heavy alcohol use among college students reflects a problem that is beyond simply a psychological, clinical, or developmental problem; it is one that is firmly rooted in the culture of college and in an environment that promotes a heavy-drinking lifestyle. Alcohol use and the problems that result from excessive drinking have been part of the American college experience since colonial days, although intensive study of this issue has not occurred until more recently. The first large-scale national survey of college student drinking was conducted by Straus and Bacon in 1950, and since that initial work more than 2,000 studies of college student alcohol use have been conducted. Unfortunately, few of these have involved rigorously conducted surveys of nationally representative samples of students and colleges. Studies of this nature can examine how drinking patterns are distributed and identify the factors that are associated with higher or lower levels of use. What is currently known from studies that meet criteria for sound scientific research is summarized in this entry.

#### RATES OF HEAVY DRINKING

The Harvard School of Public Health College Alcohol Study (CAS) was the first attempt to provide

a comprehensive description of college drinking using a nationally representative sample of colleges and students. This study found that a sizable minority of students nationally are binge drinkers—defined as five or more drinks in a row for males and four or more drinks for females on one or more occasions during a 2-week period. Two in five students (44%) attending college in the United States drink alcohol at this level or greater. The drinking style of many college students is one of excess and intoxication. Almost half of college students (48%) report that drinking to get drunk is an important reason for drinking; one in four (23%) drinkers drink 10 or more times in a month; and 3 in 10 (29%) drinkers report being intoxicated three or more times in a month.

This level of drinking has been found in four national CAS surveys between 1993 and 2001. Similar rates have also been reported by other national surveys, including the CORE survey, the Monitoring the Future Study, the National College Health Risk Behavior Survey, and the National Household Survey on Drug Abuse.

Alcohol use/abuse is a significant threat to the health and well-being of college students in the United States. The harms and secondhand effects of alcohol that students experience are directly associated with the amount of alcohol they or their peers consume. Alcohol-related harms include academic difficulties, psychosocial problems, antisocial behavior, physical injury, high-risk sexual behavior, overdose, and other risk taking, such as alcohol-impaired driving. Table 1 indicates that frequent binge drinkers are much more likely to report experiencing educational, health-related, interpersonal, and legal consequences than those who drink but do not binge.

The burden of college student drinking is high. More than 1,400 U.S. college students per year die from alcohol-related unintentional injuries, the majority in motor vehicle crashes. More than 2 million of the

8 million students drove a motor vehicle under the influence of alcohol, and more than 3 million rode with an intoxicated driver. Over 500,000 students were unintentionally injured while under the influence of alcohol.

The impact of college student alcohol abuse is not limited to the drinkers themselves. Students who attend schools with high rates of binge drinking experience a greater number of secondhand effects, including disruption of sleep or studies, property damage, and verbal, physical, or sexual violence, than their peers attending schools with low binge drinking rates. Recent estimates suggest that more than 600,000 college students per year are hit or assaulted by another student who has been drinking. In addition, residents of neighborhoods near heavy-drinking schools experience higher rates of noise disruptions, property damage, and police visits than those who live in neighborhoods surrounding schools with lower rates of heavy drinking and those who do not live near a college.

## HIGH-RISK STUDENTS

The study of alcohol use among college students has provided important insight into the factors associated with heavy drinking. Perhaps the most important finding of the CAS is that drinking behavior is not evenly distributed among different groups of college students. High rates of binge drinking exist among fraternity and sorority members, athletes, sports fans, highly social students, and those who engage in other risky behaviors. Underage students drink more heavily than their peers who are of legal drinking age, but they do so on fewer occasions. Some groups of students consume less alcohol or do not drink at all, in particular students of African and Asian descent; women; those with strong religious beliefs; and married, older, or nontraditional students.

Socializing is a major correlate of heavy drinking, and not surprisingly, students at the forefront of college social life use alcohol heavily. Students involved in fraternity and sorority life and athletics, two of the most prominent focus points of social life on campus, are among the heaviest drinkers. Beyond the high rates of binge drinking among fraternity and sorority house residents and members, fraternity parties also serve as a major source of alcohol for college students under the legal drinking age.

Where students live during college is an important factor in how much alcohol they consume. Rates of binge drinking vary according to the level of supervision

in their living environment and their proximity to other heavy drinkers. Among underage students, those living at home with their parents have the lowest rates of binge drinking. Among those living on campus, residents in housing designated as substance free (where students agree not to use alcohol and tobacco products) have the lowest rates of binge drinking. Students living off campus independent of their parents and students living in fraternity or sorority houses have the highest rates of binge drinking.

The transition from high school to college is a significant milestone in a young person's life. Entirely new social environments and the adoption of more adult roles as students become independent of their parents mark this change. This developmental perspective is an important factor in considering both risks for engaging in binge drinking and for prevention efforts. While many college students engage in binge drinking prior to their arrival on campus, a substantial number of students pick up binge drinking behavior in college. Student affiliations and their surrounding environments are important determinants of initiating drinking behavior in college.

## CONTRIBUTING FACTORS IN THE ENVIRONMENT

The intense study of college student drinking in the decade of the 1990s has resulted in significant gains in the understanding of this topic. However, the overwhelming majority of studies conducted have focused on factors that are proximal to the individual, such as personal and family drinking and other substance use history; social context; and individual beliefs, intentions, or expectations about alcohol use. The majority of these studies have been limited to single-school samples, or when several colleges are included, from opportunistic rather than representative samples. Studies of this nature are unable to examine features of the environment that may contribute to alcohol use and problems because these factors are held constant. As a consequence, far less attention has been given to environmental factors that may influence college student drinking. These include state, local, and college-level laws; policies regarding the sale and consumption of alcohol; and the enforcement of these standards.

Rates of binge drinking vary dramatically by college (ranging from 1% to 76%), by region of the country (higher in northeastern and north-central states,

lowest in western states), and importantly, by the sets of policies and laws governing the sale and use of alcohol at the college, city/town, and state levels. Understanding the patterns of drinking by different groups of students can help identify potential intervention strategies to reduce alcohol consumption, and, in turn, the harms that result from heavy consumption. Interestingly, features of the environment such as residential settings, low prices, and a high density of alcohol outlets are significantly related to the initiation of binge drinking in college. This combination of factors in the environment that promote heavy drinking is referred to as a “wet environment.”

A consistent finding of the CAS has been that the price students pay for alcohol is an important factor in their drinking. Low price and very easy access to alcohol are strong correlates of underage drinking. Student underage drinking and binge drinking are sensitive to the price of alcohol and may be reduced by efforts to increase the unit price of alcohol. Students who pay a higher price for alcohol are less likely to make the transition from abstainer to moderate drinker and from moderate drinker to heavy drinker.

Some campus, local, and state policies that target alcohol use are associated with less drinking and binge drinking among college students. Students attending colleges that ban alcohol are less likely to binge drink and more likely to abstain from alcohol. As a result, fewer students at schools that ban alcohol experience secondhand effects of the drinking of others than students at non-ban schools. At schools that allow students some access to alcohol, substance-free residences are associated with less alcohol use and fewer secondhand effects of alcohol.

State and local alcohol policies are also associated with drinking behavior among college students. Strong state and local drunk driving policies targeting youths and young adults significantly reduce drinking. The national Minimum Legal Drinking Age (MLDA) law in the United States appears to be an effective deterrent against heavy drinking and its negative consequences. The enactment of this law was associated with a significant decrease in traffic fatalities involving drivers 18 to 20 years of age. Since 1975, the MLDA of 21 has saved an estimated 20,000 lives in collisions involving drivers in this age group. Alcohol-involved motor vehicle crashes are a leading cause of death and serious injury for college students. Beyond the MLDA law, other restrictions on sales to and possession by persons under the legal drinking

age are associated with less drinking by underage college students. Underage students in states with extensive laws restricting underage and high-volume drinking are less likely to drink and to binge drink.

## FUTURE DIRECTIONS

A significant amount of time, energy, and money has been devoted to the issue of college student drinking by college administrators and prevention planners. The activity to date has focused on efforts to educate drinkers or on providing treatment and judicial sanctions for the most serious offenders. Features of the environment that promote heavy alcohol use, such as college drinking traditions, lax policies or enforcement, easy accessibility to cheap alcohol, and gaps in service networks, have received far less attention as prevention efforts.

While researchers have learned a great deal about describing the problem of college student binge drinking, and intensive efforts have been undertaken to address the problem, very little progress has been made in reducing alcohol consumption in this population. Unfortunately, despite the high rate of problems experienced by students who engage in frequent binge drinking, very few of them recognize their problems on their own. Less than one quarter of frequent binge drinkers think they ever had a problem with alcohol and only 13% of this group think they are heavy or problem drinkers. As a result, among this heaviest-drinking group less than 3% have sought help for their drinking.

These findings suggest that additional efforts may be necessary. The findings of the CAS strongly suggest that limiting access to alcohol is a promising strategy to reduce the harms and secondhand effects. Building individual-level resistance skills may be an ineffective or incomplete strategy in the face of a heavy-drinking culture and promotional activities by national and local alcohol industries to entice college students to drink heavily. Given the limited success of efforts to date and the mixed evidence of efficacy from the most intensely studied individually focused interventions, further efforts might be directed toward limiting the exposure of college students to aggressive marketing or increasing counter-advertising, reducing the easy access to low-priced alcohol, and limiting the high density of alcohol outlets. These strategies, often referred to as “environmental management,” represent a promising avenue for prevention of alcohol-related problems. A recent expert panel convened by the



Substance Abuse and Mental Health Services Administration (SAMHSA) summarized the findings in this area and recommended that interventions addressing these areas were feasible and effective.

Efforts to reduce student alcohol use and abuse may require coalitions of people representing various interests and strong grassroots organizing. If and when colleges or those who live in college communities implement these types of interventions to reduce alcohol use and abuse among students, they should be rigorously evaluated to determine their effectiveness.

—Henry Wechsler and Toben F. Nelson

See also ALCOHOL ABUSE AND DEPENDENCE

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## BIOFEEDBACK

Biofeedback is a widely used method for teaching people voluntary control of various physiological functions by providing instantaneous information about the status of the person's physiological activity. Feedback usually is given in the form of visual and/or auditory signals derived from physiological recording devices. People can use biofeedback to obtain voluntary control over their bodies. Biofeedback methods have been successfully applied to treating a wide variety of ailments, including headache and other chronic pain conditions, hypertension, vasospastic diseases, incontinence, and insomnia (Schwartz & Andrasik, 2003).

Biofeedback is easy to learn, with competent practitioners located in or near most communities. Equipment to perform it is readily available at reasonable cost (from about \$300 for clinical units to about \$3,000 for units with research capabilities). Most patients find it intriguing and enjoyable, and compliance tends to be at least as high as with various medical treatments for chronic diseases. Special software programs have been written for children, where biofeedback is structured as a video game in order to maintain interest in the process.

### CARDIORESPIRATORY BIOFEEDBACK

Biofeedback can be successfully used to teach people to control various cardiovascular and respiratory functions, for example, blood pressure, heart rate and heart rate variability, blood flow to specific body organs, and respiration rate and resistance.

*Surface temperature.* The most widely studied and commonly used cardiovascular biofeedback method has

been thermal biofeedback. In this method, a sensor (usually a thermistor) is attached to a target organ (most frequently one of the extremities), and people are given immediate feedback that is sensitive to a tenth of a degree Fahrenheit or less. Changes in local body temperature usually reflect changes in blood flow, mediated by dilation or constriction of blood vessels in the area.

Teaching people to warm their extremities can be helpful for Raynaud's disease, a problem involving spasms in the blood vessels to the extremities that can lead to severe discomfort and susceptibility to infection. Preliminary controlled research has shown that finger temperature biofeedback also can reduce blood pressure among individuals with hypertension.

*Heart rate.* A number of investigators have used biofeedback to teach people to increase or decrease their heart rates by direct heart rate biofeedback. This method can decrease the heart rate responses to stressful or painful stimuli, and decrease associated pain perception and anxiety.

*Blood pressure.* Direct biofeedback for blood pressure levels has also been attempted, using devices that can measure beat-to-beat blood pressure, thus assessing immediate changes. A controlled trial among hypertensive patients showed that systolic blood pressure decreased more (about 10 mm Hg) with biofeedback than with a control treatment. A recent controlled trial among patients with "white coat hypertension" (i.e., high blood pressure in the physician's office but not in other settings) found that blood pressure decreased by 23/11 mm Hg in the treatment group, with no change in the control group.

*Heart rate variability.* A relatively new biofeedback method involves teaching people to increase heart rate variability. The cardiac system, like most biological systems, demonstrates constant variation when in a healthy (or homeostatically balanced) state. When successive interbeat intervals are plotted against time, a pattern of regular oscillations has been found in several frequency bands (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). It has long been postulated that a pattern of high-amplitude oscillations across frequency bands and of successive interbeat heart intervals that are less predictable (or more "chaotic") is associated with health, fitness, survival, and adaptability.

Due to resonant properties of the cardiovascular system, high amplitudes of heart rate oscillations can be generated at specific frequencies, sometimes as high as 60 beats/minute peak-to-trough among young healthy adults, when people breathe slowly, at frequencies associated with nonrespiratory reflexes. Particularly high amplitudes can readily be produced at approximately 0.1 Hz (6 cycles per minute) by breathing at this rate, a rhythm that reflects baroreflex activity. The baroreflexes are important modulatory reflexes by which increases in blood pressure induce decreases in heart rate and vascular tone, while decreases in blood pressure induce increases in these functions. Respiration also causes an oscillation in heart rate, known as respiratory sinus arrhythmia. This rhythm usually is at a higher frequency (0.15-0.4 Hz). Recent research has indicated that biofeedback training to increase amplitude of heart rate variability causes people to breathe slowly (indeed, at approximately 0.1 Hz), thus producing robust increases in gain of the baroreflexes. In this process, biofeedback causes people to breathe at about six breaths per minute, thus producing higher-amplitude oscillations in heart rate, that are associated with both respiration and oscillations in blood pressure. Resonance occurs at this frequency, leading to very high amplitudes of heart rate variability.

This method also appears to have clinically significant effects on asthma. Case studies have suggested that it also may be useful for treating other disorders involving autonomic hyperreactivity.

*Respiratory rate.* Slow breathing has long been a component in various Eastern meditative practices that produce profound psychophysiological effects, including a sense of "centeredness" and clinical effects similar to those described for heart rate variability biofeedback. Cultivated slow breathing rates (often at about 6 cycles/minute, as in heart rate variability biofeedback), included in various yoga exercises and/or respiratory biofeedback, have been found helpful for treating hypertension, asthma, and anxiety. When applied this way, the effects of this method are very similar to those of biofeedback training for increasing heart rate variability.

*Other respiratory parameters.* Direct continuous biofeedback of respiratory impedance using oscillation pneumography has been successfully used to improve respiratory function in asthma. Biofeedback

training to increase end-tidal CO<sub>2</sub> has been successfully used in treating several cases of panic disorder.

## BIOFEEDBACK FOR SKELETAL MUSCLE ACTIVITY

Biofeedback for the muscles is called surface electromyography (SEMG). As our muscles contract, getting shorter and moving our bones or the skin on our face, the muscle fibers that cause this movement “depolarize,” giving off bundles of electrical energy that can be picked up using electrodes placed over these muscles. This energy is displayed on a computer screen and may then be “fed back” to the individual by converting it to audio tones, time-series line graphs, or other forms of visual display.

John Basmajian (1962) is sometimes referred to as the father of EMG biofeedback. He used biofeedback from concentric needle EMG recordings to teach a person how to control the “neuromuscular” system down to a small nervous system component called the “single motor unit.” Muscles consist of hundreds of motor units. For example, the large bulging muscle of the upper arm, the biceps, contains thousands of muscle fibers. These fibers are organized into bundles of approximately 100 muscle fibers, with each bundle controlled by a single neuron from the brain or spinal cord.

Edmund Jacobson used SEMG biofeedback as an assessment device to assist patients in healing themselves through a technique called “progressive relaxation.” Here the patient was trained to recognize and control subtle amounts of muscle tension by systematically tensing and releasing specific muscle groups throughout the body, with progressive decreases in the amount of tension applied. In this clinical context, SEMG biofeedback was used to provide precise information about tensing and releasing the muscles, but not yet as a training method. Jacobson and his followers taught patients to relax their muscles in everyday life as well as in the treatment room, and found that they thereby helped patients to control a variety of symptoms including headache, muscle aches, gastrointestinal symptoms, cardiovascular symptoms, and anxiety.

Later, Elmer Green applied SEMG feedback to assist in relaxation, and Thomas Budzynski et al. conducted the first scientifically based clinical study to demonstrate the clinical effectiveness of using SEMG biofeedback in treating tension headaches.

Over the years, SEMG biofeedback training has been used adjunctively to assess and treat a variety of medical disorders, including stroke, subvocalizations during reading, temporomandibular joint disorders, neck pain, shoulder pain, back pain, hip dysfunction, knee pain, repetitive strain injury, chiropractic subluxations, pelvic pain, and urinary and fecal incontinence. This research has recently been reviewed (Cram & Kasman, 1998; Kasman, Cram, & Wolf, 1998).

The use of high-speed computers to analyze SEMG data has demonstrated that the energy spectra of muscle activity gives considerable information about muscle fatigue and may help to describe back pain. Linear arrays of SEMG electrodes can be used to visually track the depolarization of the muscle fiber along its length. Periodic rest during work has been found to be very important for muscle health. Cram (1990) has developed a clinical procedure called “muscle scanning,” which allows the clinical practitioner to visualize patterns of muscle tension or bracing throughout the head, neck, and torso. A consensus paper on the use of SEMG has recently been published (Hermens et al., 1999). The clinical applications for this tool will continue to develop as the future unfolds.

## NEUROFEEDBACK

Neurofeedback (NF) is a kind of biofeedback in which the physiological event targeted for operant change involves central nervous system activity. In recent years, NF typically has involved electroencephalographic (EEG) activity, and the goal of the NF training is a clinical one. For example (and this will be expanded below), since it is known that increased low-frequency EEG activity (theta) and decreased higher-frequency activity (beta) are typical EEG correlates of attention deficit disorder (ADD), the most well known protocol for treating ADD with NF involves operant training to increase the beta-to-theta ratio.

Many of the earliest studies of NF had no aims other than the theoretically important aim of showing that nontrivial changes in neural events could be made by operant conditioning. Joe Kamiya devised the only protocol for relaxation approved by the Food and Drug Administration, increased alpha generation. Abraham Black studied the relationship of hippocampal theta training to learning and to motor processes.

On the other hand, even pioneering researchers in this area saw the clinical potential of the NF method.

Wolpaw et al. (2000) have recently developed NF-based means for allowing communication to and from paralyzed patients previously unable to communicate. Rosenfeld's (1995) group has demonstrated that operant control (NF) of cortical somatic sensory evoked potentials (EPs) can profoundly affect the pain thresholds in rats. The NF training had an effect equivalent to a moderate dose of morphine. This approach, however, has had minimal follow-up in human clinical patients.

Another pioneering effort in NF has been the work of Barry Sterman, who noted that by training patients with convulsive disorders to increase the amount of 12- to 14-Hz activity on the scalp area overlying the sensorimotor cortex, he could greatly reduce their seizure incidence. This activity (also called SMR for sensorimotor rhythm) is also seen in cats. To show that the therapeutic effect in human patients was not simply a placebo or transference cure, Sterman demonstrated that cats trained to generate increased SMR show much greater resistance to seizure elicitation by the strongly epileptogenic substance monomethyl hydrazine. There were fewer seizures in the trained cats, the elicited seizures were less severe, and the seizure onset times from exposure to the drug were longer. Here, clearly, was an NF application suitable for clinical trials, but again, for some reason, this effective NF protocol, the only one until very recently in which control studies were available, has been largely ignored by the neurology and psychiatry communities that treat persons with epilepsy.

The most influential and best-known NF protocol is that developed by Lubar and associates for the treatment of ADD. Lubar, Monastra, and colleagues have established beyond question that ADD is associated with EEG slowing, that is, an abnormal increase in slow-wave EEG activity and an abnormal deficiency of high-frequency beta activity. With this sound empirical and conceptual foundation, they developed and repeatedly tested successfully an NF protocol known as the beta-theta or Lubar protocol for ADD. There have been dozens of independent clinical replications, and a controlled study has recently been reported (Monastra, Monastra, & George, 2002). This study compared therapeutic effects of Ritalin, the standard medical treatment for ADD, with the Lubar protocol in treatment of ADD. It was found that both therapies affected ADD symptoms, but that the effects of Ritalin were absent when the substance was cleared 24 hours after administration. On the contrary,

the effects of the Lubar protocol were long lasting. In particular, the effects of the Lubar protocol affected the EEG so as to normalize it. Ritalin did not have these effects on the core neural sign of ADD, the cortical slowing.

Rosenfeld, Baehr, and colleagues (Rosenfeld, 2000) have presented a clinical protocol and several case reports showing that NF can be used to produce clinically beneficial effects on mood disorders. The conceptual and empirical foundation for the protocol is as follows: Early research by Leonide Goldstein and later findings by Richard Davidson and colleagues had repeatedly shown that negative affect is associated with more right than left frontal cortical alpha activity, an *inverse* index of activation. Normal or positive affect shows the reverse frontal cortical asymmetry of activation. Thus, the "asymmetry protocol" developed by Rosenfeld reinforces depressed subjects for reversing the pathological to the normal activation asymmetry pattern.

## CONCLUSION

Biofeedback has been successfully applied as an aid to teaching people to control various physiological functions. Although officially listed as a method of "complementary" medicine by the National Center for Complementary and Alternative Medicine of the National Institutes of Health, its effects on several disorders have been sufficiently well established for the method to have become part of standard clinical practice. Its strong effects also make biofeedback a useful educational tool for teaching about the body and improving human performance.

—Paul Lehrer, J. Peter  
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See also PSYCHOPHYSIOLOGY: THEORY AND METHODS

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## BLOOD PRESSURE AND HYPERTENSION: MEASUREMENT

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Hypertension (high blood pressure) is a major risk factor for cardiovascular morbidity and mortality. As such, the accurate measurement of blood pressure (the pressure in the blood vessels associated with the flow of blood with each heart beat) and the assessment of hypertension are essential to the health of the population. In the 175 years since Poiseuille described the use of the mercury manometer to measure blood pressure, the accurate assessment of blood pressure has remained a challenge to clinicians and researchers alike (Jones, Appel, Sheps, Rocella, & Lenfant, 2003;

Poiseuille, 1828). The early assessments required invasive measures to attach an artery to the recording device, severely limiting the routine assessment of blood pressure. However, recent advances now permit blood pressure to be recorded on a beat-to-beat basis in ambulatory subjects thus allowing blood pressure to be linked to environmental, situational, and behavioral factors (Parati, Omboni, & Mancia, 1995).

This entry briefly describes the measurement of blood pressure and the assessment of hypertension in both the clinical and research contexts. The physiological basis of blood pressure is described first, then the clinical basis for the assessment of hypertension. Next, an overview of the measurement of blood pressure in the research and ambulatory settings is provided. Finally, new indices derived from blood pressure measurements including pulse pressure and blood pressure variability and their associations with end-organ damage and cardiovascular disease risk are presented.

### PHYSIOLOGICAL BASIS OF BLOOD PRESSURE

The maintenance of blood pressure (BP) is one of the primary functions of the organism (Julius, 1988). Whereas the exact determinants of BP cannot be assessed noninvasively, noninvasive measures may provide important information for clinicians and researchers. A simplified approach to understanding the determinants of BP has been suggested that divides the determinants into physical and physiological factors (Berne & Levy, 1997). Physical factors include blood volume and arterial compliance (the elasticity of the arteries), whereas physiological factors include cardiac output (the amount of blood pumped by the heart in a given amount of time such as 1 minute) and peripheral resistance (the resistance of the peripheral vasculature to the flow of blood). Blood volume is a major determinant of long-term BP regulation and thus explains the use of diuretics as a first-line treatment for hypertension (Chobanian and the National High Blood Pressure Education Program Coordinating Committee, 2003). Cardiac output (CO) is a function of heart rate (HR) and stroke volume (SV: the amount of blood pumped with each cardiac contraction) such that  $CO = HR \times SV$ . Mean arterial pressure (the average pressure in the arteries over some time interval) is a function of CO and peripheral resistance. The autonomic nervous system is intimately involved in the control of BP such that changes in BP may be due to various combinations

of parasympathetic (i.e., HR), beta-adrenergic (i.e., SV), and alpha-adrenergic (i.e., peripheral resistance) activity. Recent research also points to the role of both central and peripheral nitric oxide (a biologically active molecule associated with, among many other things, the dilation of blood vessels) in BP regulation (De Meyer & Herman, 1997).

## CLINICAL ASSESSMENT OF HYPERTENSION

Normal BP, assessed on the basis of systolic (pressure during the cardiac systole or contraction: SBP) and diastolic (pressure during the cardiac diastole or relaxation: DBP) blood pressure, is considered to be < 120 mm Hg SBP and < 80 mm Hg DBP. Prehypertension has recently been defined as 120-139 mm Hg SBP or 80-89 mm Hg DBP. Stage 1 hypertension is defined as 140-159 mm Hg SBP or 90-99 mm Hg DBP, whereas Stage 2 hypertension is defined as > 160 mm Hg SBP or > 100 mm Hg DBP. Each of these levels of classification, in combination with other factors, is associated with specific risks and treatment recommendations (Chobanian et al., 2003). However, it should be noted that there is a largely linear dose-response relationship between BP levels and cardiovascular disease risk that extends across the range of BP levels (Douglas and the Hypertension in African Americans Working Group, 2003). Moreover, recent statements suggest that individualized target BPs and risk assessments may be necessary to achieve adequate BP control in individuals from certain populations including African Americans (Douglas et al., 2003).

## MEASUREMENT OF BLOOD PRESSURE IN CLINICAL AND RESEARCH SETTINGS

Most methods of measuring BP rely on intermittent measurements. These methods include the auscultatory method based on Korotkoff sounds and the oscillometric method based on the amplitude of cuff pressure oscillations (Shapiro et al., 1996). The auscultatory method is based on the perception of the sounds of the heart valves opening and closing at different points in the pressure gradient (the so-called Korotkoff sounds), whereas the oscillometric method measures the difference between pressures assessed by an inflatable cuff during the systole and diastole.

These methods can be used in both clinical and research settings. Moreover, these methods can be used for the assessment of ambulatory 24-hour BP.

Recent techniques for the continuous assessment (beat-to-beat) of BP include the tracking cuff system (Shapiro, Greenstadt, Lane, & Rubenstein, 1981), tonometric, and vascular unloading methods (Penaz, 1973). Whereas the absolute values of these latter methods have been questioned, they represent a major advancement in the quest to understand behavioral influences on BP as they allow the linking of specific, relatively short timeframe behaviors to coincident BP. Similar linking can be done with 24-hour intermittent measures but with less temporal resolution (Jacob et al., 1999). Importantly, the use of 24-hour BP has been shown to be critical for the assessment of hypertension status particularly when “white coat hypertension” (a condition in which a patient’s BP is elevated in the doctor’s office or clinic but is normal elsewhere) is present (Chobanian et al., 2003).

## OTHER INDICES DERIVED FROM BLOOD PRESSURE RECORDINGS

Whereas cardiovascular disease risk is commonly assessed in terms of SBP and DBP, other indices derived from BP recordings have been shown to be independent risk factors for end-organ damage, morbidity, and mortality. For example, pulse pressure (the difference between SBP and DBP), a measure of arterial compliance, has been shown to be an independent risk factor for morbidity and mortality, especially in older persons (Franklin, Khan, Wong, Larson, & Levy, 1999; Glynn, Chae, Guralnik, Taylor, & Hennekens, 2000). Importantly, BP variability including 24-hour standard deviation, the morning rise in BP or night-time fall of BP, and the periodicities present in 24-hour beat-to-beat BP recordings has been shown to be an independent risk factor for cardiovascular morbidity and mortality (Parati et al., 1998; Parati & Lantelme, 2002).

Factors that influence BP variability are being explored with behavioral factors prominent. In addition, the implications of BP variability for shear stress (the stress on the blood vessels caused by the ebb and flow of blood), plaque rupture (the breaking away from the wall of the blood vessel of a fatty deposit), and nitric oxide release are being investigated.

## SUMMARY

In summary, the accurate measurement of BP is crucial for the assessment of hypertension. Recent advances in the measurement of BP, particularly

ambulatory measurement, promise to enhance the prevention, diagnosis, and treatment of BP-related diseases and explicate the role of behavioral factors in BP regulation.

—Julian F. Thayer

See also BLOOD PRESSURE AND HYPERTENSION: PHYSICAL ACTIVITY; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CARDIOVASCULAR REACTIVITY; PSYCHOPHYSIOLOGY: THEORY AND METHODS

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## BLOOD PRESSURE AND HYPERTENSION: PHYSICAL ACTIVITY

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Blood pressure changes in response to physical activity include immediate responses during the activity, changes that last for a few hours after a bout of sustained aerobic exercise, and longer-term changes that are observed beginning a few weeks after sedentary individuals start a regular exercise training program. Regular physical activity is now recommended by hypertension experts and public health authorities for preventing the development of hypertension and for helping to reduce elevated blood pressure in individuals who have already been diagnosed with mild to moderate levels of hypertension. Both aerobic and strength-training type exercises can be safe and beneficial if performed within recommended guidelines.

## OBSERVATIONAL EVIDENCE

Some of the evidence about the importance of physical activity for cardiovascular health and blood

pressure regulation comes from observing large numbers of people for long periods of time to determine what distinguishes those who go on to develop hypertension from those who do not. In a study of Harvard University alumni, men who reported regular participation in vigorous sports 1 to 2 hours a week were much less likely to develop hypertension as they grew older. Another important observational study involved thousands of people who had undergone fitness testing at the Aerobics Center in Dallas, Texas. Investigators found that those who had lower levels of physical fitness (and therefore probably engaged in less regular physical activity and exercise) were much more likely to develop hypertension. Studies conducted in other countries with individuals of different genetic backgrounds have similarly found that people who are more physically active and/or with higher levels of physical fitness are likely to have lower blood pressure and are less likely to be diagnosed as hypertensive. These observations have encouraged investigators to learn how physical activity helps regulate blood pressure and whether exercise can be used as a non-pharmacological treatment for people whose blood pressure is too high.

#### IMMEDIATE RESPONSE OF BLOOD PRESSURE DURING PHYSICAL ACTIVITY

With the initiation of rhythmic muscle contractions in aerobic physical activity, such as walking, jogging, or cycling, many changes occur in the cardiovascular system to provide blood and oxygen to the working muscle as well as sustain the other body organs. In healthy individuals, systolic blood pressure rises rapidly, then levels off, and diastolic pressure changes very little. Following a bout of sustained aerobic activity, the blood pressure falls to a lower level and remains lower than the usual resting level for several hours.

Resistance type exercise causes different cardiovascular responses. With the strain of weight lifting or other resistance activity, blood pressure rises quickly, even if the work does not require great effort. For this reason, individuals who have cardiovascular disease or elevated blood pressure should seek medical advice before starting resistance exercise training. With regular resistance training, the immediate blood pressure response is lessened and the short-term changes do not cause sustained high blood pressure.

#### RESPONSE OF BLOOD PRESSURE TO SUSTAINED EXERCISE TRAINING

More than 50 studies have now been reported on the effects of weeks or months of exercise training on blood pressure. Many, but not all, of the studies have found a beneficial effect. Some of the studies have been conducted in a manner that demonstrated the blood pressure-lowering effect occurs even without changes in weight, diet, or other lifestyle factors.

Recently, several studies have used meta-analysis, a method of pooling the results of previously published studies, to determine the amount of blood pressure change that occurs with aerobic exercise and what factors may affect the amount of change that is observed. These meta-analyses concluded that regular aerobic (endurance) exercise lowered blood pressure, even if there was no weight change. On average, the exercise used in experimental studies lowered systolic blood pressure by about 3 to 4 mm Hg and lowered diastolic blood pressure about 2 to 3 mm Hg. Individuals within the studies experienced a wide range of blood pressure change, and some studies found greater changes than others. The meta-analyses compared subgroups of individuals across the studies to look for predictors of greater blood pressure effects. These analyses suggest that both normal-weight and obese individuals benefit from exercise training but that those who are already hypertensive compared with normotensives, individuals of African and Asian origin as compared with those of European ancestry, men as compared with women, and middle-aged as compared to older individuals may experience the largest blood pressure changes in response to aerobic exercise. More research is needed to confirm these possible differences between subgroups.

Another important question is what type of exercise is best and how much exercise is necessary for benefit. These questions have not been fully answered. The exercise used in successful experimental programs thus far included brisk walking, jogging, cycling, aerobic dance, and swimming. Almost all the programs studied have been of sufficient intensity to increase cardiovascular fitness, with the exercise performed three to five times per week for at least 20 to 30 minutes duration, with heart rate at 50% to 80% of the maximum. Only a few studies have examined the effects of resistance training on blood pressure. These studies have generally shown that regular participation in resistance training type activity can lower resting blood pressure and does not lead to blood pressure increases.



## HOW DOES PHYSICAL ACTIVITY LOWER BLOOD PRESSURE?

The mechanisms for blood pressure reduction by aerobic exercise are still not fully understood. Exercise is a complex set of behaviors, causing different effects depending on the specific type of activity, the intensity or effort with which it is performed, the duration of the exercise training sessions, and the frequency of the exercise. Experts believe that aerobic exercise may help reduce blood pressure through a variety of changes, including decreases in the volume of fluid retained in the body, vasodilatation, changes in the input to pressure receptors in the cardiovascular system, and reducing sympathetic nervous system activity.

## PHYSICAL ACTIVITY AND HYPERTENSION PREVENTION AND TREATMENT

While the average amount of blood pressure change that occurs with regular exercise may seem small for an individual who would like to avoid taking medication for hypertension, some individuals will experience greater blood pressure lowering, especially those who adjust their diets and lose weight in addition to increasing their physical activity. Even without weight changes, if many more children and adults in the population adopted healthy physical activity consistent with current public health guidelines, many thousands of cases of hypertension would be prevented. It is also important to note that regular physical activity and exercise provide many other cardiovascular risk reduction effects and other health benefits. Thus, regular physical activity and exercise are important for health and quality of life of all individuals, even if they do not experience significant changes in blood pressure.

—Patricia M. Dubbert

See also BLOOD PRESSURE AND HYPERTENSION:

MEASUREMENT; BLOOD PRESSURE, HYPERTENSION, AND STRESS; PHYSICAL ACTIVITY AND HEALTH

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## BLOOD PRESSURE, HYPERTENSION, AND STRESS

Essential hypertension or high blood pressure affects almost 50 million Americans and is a major contributor to mortality from cardiovascular disease, the leading cause of death among Americans. Hypertension increases risk for a variety of medical conditions, including myocardial infarction, stroke, congestive heart failure, peripheral vascular disease, hypertensive retinopathy, left ventricular hypertrophy, kidney failure, and cognitive impairment. This disease disproportionately affects the poor, the elderly, and African Americans. Prevalence of hypertension is 40% higher among African Americans compared to White Americans, and African Americans develop the disease at an earlier age, experience a more severe course, and are at higher risk for left ventricular hypertrophy, stroke, renal disease, and hypertension-related mortality than all other ethnic groups in the United States.

There is general consensus that hypertension is a multiply determined disease with no known specific cause. However, beginning with Franz Alexander's early psychodynamic theory, considerable scientific attention has been given to understanding how psychosocial stress and personality characteristics might contribute to hypertension risk.

The notion that stress should be implicated in enhanced hypertension risk has heuristic appeal; however, efforts to demonstrate a causal role for stress in hypertension have been unsuccessful for several reasons. First, sustained high blood pressure is likely the result of several etiologic factors, including genetic, biomedical, socioecologic, behavioral, and psychological risk factors, all of which exert their effects in interaction and over time. Second, there is substantial evidence that hypertension is most likely to develop in persons who are genetically predisposed to this disease and less likely to develop in those who lack this biological predisposition, even in the presence of other

environmental and lifestyle risk factors. For example, studies in both animals and humans suggest that genetic vulnerability and sodium sensitivity may be major pathways of risk for stress-induced hypertension, such that individuals who are sodium conservers (i.e., have a tendency to retain sodium) may be more vulnerable to the cardiopathogenic effects of stress than those who are more efficient sodium excretors. Third, researchers generally agree that stress is best thought of as a general risk factor that can contribute to a variety of medical and psychological disorders, but is not a specific causal factor in any disease or disorder. Therefore, the contribution of stress to risk for hypertension must be considered in the context of genetically mediated predispositions, and the host of other co-occurring and interacting factors noted above.

This entry provides a brief review of the evidence linking psychosocial stress to essential hypertension in terms of (1) stress exposure, (2) stress appraisal and coping, and (3) the biobehavioral stress reactivity hypothesis. The entry also reviews results of studies of behavioral treatments for essential hypertension.

## GENERAL MODELS OF STRESS AND DISEASE

Various models of stress have been formulated to explain how various sources and types of stress translate into symptoms of disease and dysfunction. Modern models of stress and disease propose complex relationships between *stress exposure*, which involves experience with episodic and chronic environmental demands, and *stress response*, which involves emotional, physiological, and behavioral responses to the appraised stressor, and their reciprocal relationships. These models also recognize the importance of several factors that moderate or mediate the experience of stressors and the development of symptoms and illnesses, including *stress appraisal*, which involves estimating the relative threat of stressors by weighing demands against available resources; *social resources for support*, which may either protect or reduce the detrimental effects of a high stress burden; *psychosocial resources* such as self-efficacy and self-esteem; and *stress coping*, which involves psychological and/or behavioral efforts to manage the appraised stressors.

## MODEL OF STRESS AND HYPERTENSION

In the specific case of hypertension, a stress-mediated model for this disease would suggest that

(1) greater exposure to or burden of psychosocial stresses will enhance risk for developing essential hypertension in those who possess biological predispositions for this disease; (2) the effects of greater stress burden will be exacerbated by socioecologic factors, such as disproportionate burden of stress due to family and job stresses, socioeconomic deprivation and discrimination, and detrimental lifestyle factors, such as obesity, high salt/fat diet, smoking, alcohol abuse, and a sedentary lifestyle; (3) stress burden will be mediated through cardiovascular hyperreactivity, which is hypothesized to result in sustained high blood pressure by dysregulating blood pressure control mechanisms; and (4) the effects of stress exposure will be moderated by psychological and social factors such as social supports, and emotional regulation, especially anger suppression, hostility, and repressive coping.

## STRESS EXPOSURE AND HYPERTENSION

### Stressful Environments

Stressful environments have the potential to significantly affect blood pressure. Multiple types of threatening environments, such as wars, low-income urban residential areas, and noisy workplaces, have been related to prolonged increases in resting blood pressure. One widely cited 20-year prospective study demonstrated that exposure to normal daily living in Western society compared to secluded monastic living is associated with age-related increases in blood pressure over 20 years (Timio et al., 1988).

Environments that contain recurrent social conflict also are associated with marked blood pressure increases. For example, researchers studying the effects of crowding on prison inmates found that inmates who lived in dormitories had higher resting blood pressures compared to inmates who lived in single cells and that blood pressure levels changed when inmates were transferred to and from single cells to dormitories (D'Atri, Fitzgerald, Kasl, & Ostfeld, 1981).

### Stressful Cultures

There is evidence that the chronic stress of social change and competition for resources is a factor affecting blood pressure in modernized countries, with a strong graded relationship between population blood pressure and level of industrialization. However, stresses due to modernization and acculturation do not operate independently on blood pressure, but are associated

with changes in physical activity, obesity, dietary intake, social integration, and social support, all of which also contribute to enhanced risk for hypertension.

### Occupational Stress

Karasek and colleagues (Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981) developed one of the first models linking high job strain with increases in ambulatory blood pressure. High job strain, defined as high work demands and low decisional latitude, has consistently been linked with higher resting blood pressure at work, and this effect generalizes outside of work and during sleep. These job strain effects have been observed only when ambulatory blood pressure monitoring (ABPM) is used. Other risk factors, such as alcohol consumption, age, and gender, have been shown to moderate job strain, such that those in high-strain jobs evidence higher resting blood pressure if they are older, consume alcohol, and are men. Surprisingly, high-strain jobs appear to have little effect on blood pressure in women, suggesting that there may be important gender differences in the appraisal, experience, and/or physiological reactions to job demands.

### Racism and Discrimination

African Americans have 2 to 4 times higher rates of hypertension than other ethnic groups in the United States. This greater burden of morbidity and mortality from this disease is attributable to several factors, including genetic history, greater tendency toward sodium retention, disproportionately higher rates of obesity (particularly in women), and lower intake of calcium, potassium, and magnesium. Socioenvironmental stressors are also important contributors to disproportionate risk. A disproportionate percentage of the African American population live under conditions of economic deprivation, with concomitant greater exposure to multiple stresses (e.g., crime, heightened vigilance) and inadequate material and psychosocial resources (e.g., health care). Exposure to racism and discrimination are significant contributors to this stress burden and have been linked specifically to enhanced risk for hypertension (Williams & Neighbors, 2002).

While the amount and type of racism and discrimination in the United States may have changed in recent years (i.e., a shift from overt to more covert forms of discrimination), exposure to discrimination continues to create a psychologically threatening and undermining

environment and limits access to resources and life opportunities. These psychosocial and environmental stresses can also lead to the development of negative coping styles that can further enhance risk for hypertension, such as use of illicit drugs and alcohol, excessive eating, smoking, and unresolved anger and hostility.

### Lifestyle Incongruity

Another source of stress that has been linked to enhanced risk for hypertension is lifestyle incongruity, which involves maintaining a lifestyle that exceeds economic resources. Studies have found higher resting blood pressures and higher rates of hypertension in African Americans with high lifestyle incongruity (Dressler, 1991). However, to date, this relationship has not been observed in other ethnic groups and may be indirectly related to the effects of discrimination on the ability of many African Americans to achieve material security, which becomes an additional chronic stressor.

## STRESS APPRAISAL, COPING, AND HYPERTENSION

Stress exposure is not a necessary or sufficient condition in predicting increases in resting blood pressure, but rather the stressor must be appraised as chronically stressful in order to affect long-term, stable changes in cardiovascular responses to stress. As Thomas Pickering (1997) suggests, the best predictor of blood pressure increases is the perception that what one is doing is stressful, whether at work or at home. For example, studies of stress and social support have found that perceived stress was correlated with increases in systolic blood pressure, particularly in men. Also, although all stress exposure experiences interact with appraisal processes to influence stress responses, a number of psychological predispositions amplify the experience of being under stress and are implicated in risk for hypertension. These include anger and hostility, especially the tendencies to suppress anger and to react to anger provocation without contemplation, and high trait anxiety and depression.

## BIOBEHAVIORAL STRESS REACTIVITY AND HYPERTENSION

Exposure to stress triggers activation of a number of physiological mechanisms, including the autonomic nervous system (ANS); the hypothalamic-pituitary-adrenal

(HPA) axis; the metabolic, cardiovascular, and immune systems; and the release of stress hormones, all of which mobilize the body for action by increasing heart rate, blood pressure, and respiration, as well as mobilize the immune system to protect against infection. These normal reactions are subsequently inactivated once the stressors are removed or reduced. However, when inactivation is insufficient or incomplete, there is prolonged exposure to stress hormones, which results in an increase in physiological damage and dysfunction.

Central to the stress reactivity hypothesis is the premise that certain individuals evidence heightened cardiovascular reactivity (CVR) in response to stressful situations. Some researchers argue that this reactivity is a marker for the development of hypertension, such that consistently heightened reactivity co-occurs with and indicates dysfunction of one or more blood pressure control mechanisms. On the other hand, others have argued that repeated exaggerated CVR plays a causal role in the development of hypertension, such that repeated exposure to stress in people who are highly responsive to it results in sustained blood pressure elevations, and an individual's blood pressure eventually will be reset at a higher level. Precisely how this resetting might occur is unclear, although structural changes and heightened sympathetic nervous system activity might be potential mediators.

Several research methodologies have evolved to test the stress reactivity hypothesis. In the widely used laboratory stress reactivity paradigm, blood pressure and other cardiovascular measures are recorded before, during, and immediately following exposure to an active (e.g., mental arithmetic) or passive (e.g., cold pressor) stress task. Changes in cardiovascular parameters from baseline to the stressor task and time to recovery are used as indicators of the magnitude of cardiovascular reactivity. An underlying assumption of this paradigm is that responses to standardized laboratory tasks are good indicators of how people typically respond to stresses during their usual day.

To test the latter hypothesis, researchers have developed and refined the methodology for ABPM to capture physiological reactivity to naturalistic stressors. By wearing small, portable blood pressure monitors, periodic blood pressure readings are made during waking activities and sleep over 24 hours, and experience sampling methods are used to record moods, activities, posture, and other potential cofactors with each blood pressure measurement.

Researchers have long debated the evidence supporting the stress reactivity hypothesis and have raised a number of key questions about (1) the reproducibility, (2) lab to life generalizability, (3) predictive power, and (4) discriminatory power of individual differences in CVR.

### Reproducibility

If reactivity to stress is a trait-like marker or contributor to hypertension, then individuals should show consistent, stable cardiovascular responses to different types of stressors over time and in different settings and conditions. To date, however, the evidence of the reproducibility of blood pressure reactivity over time and in response to different stressors is weak, especially for diastolic blood pressure. Some researchers have obtained strong evidence for stability over time by aggregating reactivity across different stressors, while others have pointed out that the temporal stability of reactivity may be a meaningful individual difference, with some individuals showing consistent responses over time and others showing more variability. Evidence for the stability of reactivity across stressors is also mixed, although researchers have suggested that some groups demonstrate different patterns of reactivity to different types of stressors. For example, African Americans generally evidence a different pattern of cardiovascular stress reactivity than Caucasians to a variety of different laboratory stressors, which suggests that there may be Black-White differences in the primary biobehavioral mechanisms and psychosocial factors that contribute to disease risk in these groups.

### Generalizability

If people's responses to laboratory tasks represent how they respond to real-world stressors, then laboratory measures of CVR should yield similar results to those obtained with ambulatory measures. This correspondence is very difficult to capture because the natural environment, as opposed to highly controlled laboratory situations, contains a number of uncontrolled factors that can influence blood pressure at any given point in time. The evidence for generalizability is mixed, with some studies reporting high associations between laboratory reactivity scores and ambulatory measures and others reporting no associations.

It may be that methodological issues contribute to these inconsistent findings. Since laboratory reactivity

occurs in response to behavioral or psychological stimuli, it should correspond to ambulatory measures recorded during real-life events with similar behavioral or psychological features. However, many studies compare laboratory measures to 24-hour ambulatory measures, during which the amount of stress encountered varies considerably from person to person and within the same person from day to day. This inter- and intraindividual variability reduces the correlations between laboratory and ambulatory measurements. Studies that have partitioned ambulatory measurements into periods of perceived or objective stress (e.g., working hours) have found greater correspondence, as have studies comparing responses to laboratory and equivalent real-world stressors (e.g., giving a speech). Still, it seems reasonable to argue that if stress reactivity is a trait, then measures of field reactivity should reflect a wide array of daily changes and that isolated naturalistic stressors thought to affect blood pressure do not provide an adequate test of this hypothesis.

Although the use of laboratory reactivity tests has not been discredited, most investigators would concede that measuring blood pressure under naturalistic, real-life conditions offers the best test of the stress reactivity hypothesis.

### **Predictive Power**

If stress reactivity marks or contributes to the development of hypertension, then cardiovascular hyperreactors should be more likely to develop essential hypertension than less reactive people. This question has been addressed in several longitudinal studies showing that high systolic blood pressure reactors to physical tasks such as the cold pressor and high diastolic pressure reactors to active psychological tasks such as mental arithmetic are at greater risk for hypertension at follow-up than low reactors.

### **Discriminatory Power**

If stress reactivity marks or contributes to hypertension, then hypertensives and those at risk for hypertension (i.e., those with a family history of the disease) should evidence heightened CVR to stressful events. Indeed, research indicates that borderline hypertensives and children of hypertensives demonstrate greater reactivity to laboratory stressors than normotensives and than children without a family history

of hypertension (Bedi, Varshney, & Babbar, 2000). Some animal research parallels these findings, with studies showing that prehypertensive spontaneously hypertensive rats (SHRs) evidence exaggerated CVR.

Finally, recent studies have identified individual differences in patterns of CVR that may have implications for the development of hypertension. For example, although participants may have similar blood pressure responses to a laboratory stressor, some might show changes mainly in cardiac output while others show changes mainly in vascular resistance.

Recent studies also have begun to focus more attention on patterns of blood pressure recovery following peak response to stressful tasks, with growing evidence that hypertensives and those at risk for this disease typically experience slower cardiovascular recovery following stress exposure than normotensives.

Thus, blood pressure hyperreactivity to stress appears to discriminate people at risk for hypertension and, in some studies, predict later development of essential hypertension. However, inconsistent methodologies have generated mixed evidence for the generalizability of laboratory reactivity to the real world, and there is limited evidence for the reliability of laboratory responses across time and stressors.

## **BEHAVIORAL TREATMENTS OF HYPERTENSION**

Our efforts to identify the contributions of stress in hypertension have been complemented by efforts to develop and test a range of behavioral approaches to the treatment of this disease. Blumenthal, Sherwood, Gullette, Georgiades, and Tweedy (2002) provided a very thoughtful review of this evidence and concluded that there are a number of behavioral approaches to the treatment of essential hypertension that have yielded positive results. These approaches offer several advantages over traditional pharmacotherapy in that they generally have no negative side effects, patients have more control over their use, and they are generally cost-effective. However, there is little justification at this time for using any of these approaches as first-line substitutes for blood pressure control medications, except perhaps as a preventive strategy for those who have high normal blood pressure or are borderline hypertensive.

Several behavioral interventions are considered effective and are frequently prescribed as first-step interventions with borderline and mild hypertensives, including reductions in dietary intake of sodium,

which has been shown to produce the most consistent and strongest correlation with blood pressure reduction; reductions in saturated fats, along with increases in intake of calcium and potassium, and weight loss; reduction or cessation of smoking and alcohol consumption; and increases in physical exercise, especially aerobic exercise of moderate intensity. However, a recent meta-analysis of randomized clinical trials with these interventions suggests that the reported beneficial effects may be overestimated because of failure to control for the confounding effects of concurrent changes in other behaviors and life circumstances (e.g., increase in exercise is often associated with reducing stress and/or the magnitude of response to stress) (Ebrahim & Smith, 1998).

There is also a very large body of published research on stress reduction or relaxation strategies for hypertension. However, because these approaches are quite diverse and are believed to exert their effects through different mechanisms, the evidence of their efficacy is rather mixed. Some of the contradictory findings can be attributed to methodological weaknesses, including inadequately described or standardized procedures; small, poorly characterized samples; weak study designs with inadequate controls and uncontrolled confounds; and problems with the analytic approaches used. Because of these constraints, this entry includes evidence of the efficacy of only two approaches that are clearly distinct and that have been tested using rigorous methodologies: transcendental meditation and biofeedback-assisted relaxation. A number of smaller studies have also reported positive results for other behavioral approaches, including general relaxation, several approaches to meditation, yoga, and progressive muscle relaxation (PMR).

### Transcendental Meditation

One of the few techniques for meditation that has been widely used and systematically studied is transcendental meditation (TM). A recent meta-analysis indicated significantly greater benefits from TM compared to other clinically devised forms of relaxation on a range of cardiovascular disease risk factors, and these benefits appear to increase proportionate to the intensity and length of time meditating (Orme-Johnson & Walton, 1998). In a randomized clinical trial with elderly African American hypertensives, Schneider et al. (1995) compared the efficacy of TM

with PMR and with a lifestyle modification control intervention, and found consistently greater cardiovascular disease benefits for TM at posttest and at 3 month follow-ups than the other two interventions. PMR also yielded positive results, but the effects were more modest and were different in men and women and in patients with high versus low cardiovascular disease risks.

### Biofeedback-Assisted Relaxation

There is also strong evidence in support of the utility of biofeedback-assisted relaxation (BAR) in the treatment of hypertension, with the best results obtained with EMG and thermal biofeedback. These studies generally report clinically meaningful reductions in blood pressure, as well as in muscle tension, urinary cortisol, and anxiety levels, and these effects are maintained in some patients up to 1 year posttreatment. Glasgow, Gaarder, and Engel (1982) reported that the best results are obtained when biofeedback is combined with and precedes relaxation training, and appears to be most effective in mild hypertensives with evidence of autonomic hyperactivity (e.g., cool hands, high heart rates) and no organ damage.

## SUMMARY AND CONCLUSIONS

Available evidence supports the hypothesis that exposure to high chronic stress is associated with enhanced risk for the development of essential hypertension, but mainly in those who are biologically predisposed to hypertension as evidenced by a family history of the disease, inefficient sodium metabolism, and cardiovascular hyperreactivity and slow recovery from exposure to acute stresses. While the debate about the meaningfulness of laboratory stress reactivity in accounting for hypertension risk continues, the most compelling and potentially useful evidence of the stress-hypertension relationship comes from studies using the latest in ABPM methodology, which allows for the measurement of blood pressure responses to naturalistic, real-life stresses. Recent studies also underscore the importance of investigating multiple sources of stress, especially those that might account for group differences in exposure to different types, sources, and amounts of stress.

To date, there is no compelling evidence that stress is an independent causal factor in this or in any other disease, but it appears to be a very important contributor

to hypertension and its sequelae. The evidence is also very strong that the stress-disease relationship is exacerbated by concurrent behavioral risk factors (e.g., obesity, high fat and sodium intake, abuse of alcohol and recreational drugs, and sedentary lifestyle) and psychological factors (e.g., repressive coping style, suppressed anger coping, high trait anxiety, and depression).

Several behavioral approaches have been tested as possible therapeutic adjuncts to pharmacotherapy in the treatment of hypertension, and current evidence indicates that while positive results have been obtained with several of these approaches, the strongest evidence of therapeutic efficacy has been obtained with TM and with BAR, especially for mild hypertensives with evidence of autonomic hyperactivity and no evidence of organ damage secondary to this disease.

—Hector F. Myers, Alison Woolery, and J. David Creswell

See also BLOOD PRESSURE AND HYPERTENSION:  
MEASUREMENT

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## BOGALUSA HEART STUDY

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### BACKGROUND

In 1972, the long-term investigation into the early natural history of arteriosclerosis, which was to become known as the Bogalusa Heart Study, received its initial funding as a Specialized Center of Research-Arteriosclerosis (SCOR-A) of the National Institutes of Health. The funding was in response to a congressional mandate to investigate the major causes of cardiovascular disease. The Bogalusa Heart Study has expanded into a long-term, uninterrupted study over 30 years and is the only study in the United States of a biracial (Black-White) community focusing on the

development of early cardiovascular risk in children. The major question of the Bogalusa Heart Study was how coronary artery disease and essential hypertension begin in a well-defined geographic and biracial (Black-White) population. The study, therefore, was descriptive and focused on observing a free-living pediatric population in a rural community, comparable to many southern areas of the United States where there is high cardiovascular disease mortality. Over the course of the study, there were seven cross-sectional surveys of school-age children, six longitudinal studies of young adults extending into middle age, and special studies related to lipids and hypertension. The study has resulted in the publication of four books, several monographs, and 700 scientific manuscripts.

The major questions that have guided the study are (1) What are the distribution and prevalence of cardiovascular risk factors in children? What methods can be used to obtain reliable risk factor information on children? How are risk factors defined in childhood? What levels of risk factor variables in children are above the norm and relate to underlying or predict future cardiovascular disease? (2) What are the inter-relationships of risk factors? Are the relationships similar to those in adults? (3) What are the secular trends in risk factors in children? How do risk factors change over time? (4) What are the determinants of risk factors in children? Do risk factors reflect genetic/environment interactions?

## MAJOR ACCOMPLISHMENTS

The most impressive accomplishments within a 30-year history can be summarized as follows:

- The major risk factors for cardiovascular disease begin in childhood, with documented relationships with autopsy changes in coronary arteries.
- Methods to study cardiovascular risk factors have been developed, and normative values from a large biracial (Black and White) population are available for national comparison.
- Levels of risk factors in children are different than those in adults. Levels change with growth phases, infancy, childhood, adolescence, and young adulthood.
- Environmental factors are significant and influence cardiovascular disease and obesity. The major modifiable factors include diet, exercise, and tobacco use.
- Lifestyles and behaviors that influence cardiovascular risk are learned and begin early in life. Cardiovascular

health education and promotion needs to begin in childhood to encourage adoption of healthy behaviors that can reduce or prevent risk factors in later life.

## BIOBEHAVIORAL STUDIES

Protocols for the Bogalusa biobehavioral studies included the following for each study variable: (1) prevalence, (2) demographic variability, (3) secular trends, (4) associations with cardiovascular risk factors, and (5) comparisons with national studies. Main areas of study were (1) tobacco and alcohol use; (2) diet; (3) physical activity; and (4) psychosocial variables, such as Type A-B behavior, learned helplessness, assertive communication, and anger.

*Tobacco and alcohol use.* Information regarding the smoking behaviors of children and adolescents has been obtained in Bogalusa since 1973 by a self-report questionnaire and has been validated with plasma thiocyanate. Some important findings throughout the study showed that White boys adopt cigarette smoking earlier than the other race/sex groups, the percentage of White girls who smoked increased and surpassed the boys by the late teens, and Black boys and girls had lower prevalence and lagged behind White children in their smoking experience. Smoking attitudes and first use were consistent over time in that parental modeling, and sibling and/or peer influence dominated. Approximately 30% of high school-age students reported regular tobacco use. Smoking was found to associate positively with alcohol use, and for White boys, this clustering was also associated with hostility.

Alcohol use has been obtained from school-age children and adolescents since 1981 by a self-report instrument similar to the smoking questionnaire. The highest percentage of regular drinkers was among White males and the lowest among Black females. Prevalence of regular alcohol consumption among school-age children (e.g., approximately 30% of high school-age students) was generally lower than national rates; however, the reported prevalence is within an age group for which purchasing alcohol is illegal in Louisiana. Young third to sixth graders' attitudes were generally negative regarding drinking alcohol, and most who had experimented had family members who consumed alcohol.

*Dietary intake/eating patterns.* Dietary data have been collected from six cohorts of 10-year-olds and two cohorts of 13-year-olds since 1973. A major finding



was that school-age children eat the typical American adult diet, characterized by high intakes of sodium, refined carbohydrates, animal protein and fat, and low intakes of potassium, complex carbohydrates, and vegetable protein and fat. Secular trends indicated that total fat intake has decreased from 38% to 34% over time. Ongoing dietary monitoring indicated that, as obesity increased, caloric energy intake remained stable but decreased when related to body weight. Over the past 20 to 30 years, school-age children on average are 5 kilograms heavier without increase in stature.

*Psychosocial factors.* The Bogalusa Heart Study was just getting started shortly after the time that the Type A-B "behavior pattern" was identified as an independent risk factor for cardiovascular disease. The Hunter-Wolf Type A Behavior Scale was developed for use with children and adolescents and was tested through direct observation for validity and reliability. This scale was used in the cross-sectional surveys and findings indicated that global Type A score increased with age and were consistently higher for White males than the other race/sex groups. Consistent associations with cardiovascular risk factors in the school-age group were not observed. Eventually, Type A declined in importance when it was found in longitudinal follow-ups of major cardiovascular adult studies that Type A no longer appeared as a risk factor for cardiovascular mortality. Hostility and "eagery" (a combination of *eagerness* and *energy*, a term coined by the developer of the Type A survey used in the Bogalusa Heart Study), however, were found to be part of the adverse components of the Type A complex. Anger/hostility, examined further, indicated that overt anger was higher in White children and repressed anger was higher in Black children.

Learned helplessness, a cognitive and behavioral response set to repeated failure, was studied in the beginning of the 1990s. It was found that learned helplessness was significantly associated with all indices of obesity for White females and with waist/hip ratio for Black females at the high school-age level. Based on identifying cardiovascular disease as present in childhood by autopsy findings and that risk factors strongly relate to underlying atherosclerotic and hypertensive lesions, the major modifiable lifestyles of poor nutrition, inactivity, and smoking need to be addressed early in life. To begin prevention as a population, or public health, approach an extensive and coordinated health education program

(Health Ahead/Heart Smart) was developed for K-6 grade school children.

—Carolyn C. Johnson and Gerald S. Berenson

See also ALAMEDA COUNTY STUDY; FRAMINGHAM HEART STUDY; KUOPIO ISCHEMIC HEART DISEASE RISK FACTOR STUDY

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## BULIMIA NERVOSA: TREATMENT

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Although bulimia nervosa (BN) was first described in the late 1970s, considerable research has been devoted to developing treatment for this disorder. At this point, several strategies with varying degrees of effectiveness are available. They include several different types of psychotherapy, as well as antidepressant medication.

### PSYCHOTHERAPY

A number of different psychotherapeutic approaches to BN have been investigated. Each has its own conceptualization of the disorder and distinct procedures for treating the problem. They include cognitive-behavioral therapy, interpersonal psychotherapy, and dialectical behavior therapy.

#### Cognitive-Behavioral Therapy

Cognitive-behavioral therapy (CBT) is based on the assumption that how we interpret events affects how we respond behaviorally and emotionally. CBT has been applied to a number of psychiatric disorders with varying degrees of success. The procedures that comprise CBT for bulimia are based on two major assumptions. The first is that the symptoms of bulimia are strongly related to attitudes toward weight and shape. Specifically, while pressures to be thin are pervasive in Western culture, those with BN are thought to be particularly vulnerable to such pressures and to gauge their own self-worth overly, if not exclusively, in terms of weight and shape. Thus, they strongly fear becoming obese. Second, it is assumed that such fears bring about unrealistic and rigid self-imposed guidelines regarding food consumption. The eating patterns of bulimics are characterized by dietary restriction, which may include attempts to strictly avoid certain foods judged to put the individual at risk for weight gain as well as habitually skipping meals. Dietary restriction, in turn, leads to binge eating both because the individual often becomes overly hungry and also may react adversely to consuming foods that are considered forbidden. One example of the latter is eating a small amount of such food, becoming upset or disinhibited by breaking one's self-imposed rule, and eating a very large quantity of that food. The individual engages in purging behavior such as self-induced vomiting or laxative abuse to "undo" the effects of a binge and avoid

weight gain. The eating pattern of the bulimic has often been referred to as consistent with a "binge-starve cycle."

CBT for bulimia is generally carried out over 18 to 20 sessions. Education about eating and weight is an important part of treatment and includes information about the ineffectiveness of laxative abuse in weight control, the negative physical consequences of self-induced vomiting, and the ways that dieting can bring about bulimic symptoms. A second key feature of treatment is self-monitoring, which involves keeping a detailed record of all eating episodes. The daily record typically includes the following information regarding food consumption: when and where eating took place, degree of hunger, type and quantity of food eaten, degree of fullness after eating, whether the person labeled the episode a binge, and whether purging took place. Self-monitoring provides important information regarding the pattern of eating including meals that are typically skipped, foods that are consumed as well as avoided, and other "triggers" for bingeing and purging episodes. A third component of treatment is changing the pattern of eating in such a way that the person learns to eat three meals daily and one or two snacks and begins to consume modest amounts of food previously considered forbidden. This takes place gradually but consistently throughout treatment. Fourth, the treatment is designed to assist the patient to critically examine and change attitudes toward eating, weight, and shape. Examples of targets for cognitive change may include catastrophic thoughts about minor fluctuations in weight, beliefs that sweets or foods rich in carbohydrates should never be eaten, and beliefs that eating three meals a day will invariably lead to substantial weight gain.

CBT for BN is considered the most effective available treatment. It is associated with reductions in bingeing and purging behavior of 80% to 90%. Approximately 40% to 50% of those receiving CBT remit, that is, stop bingeing and purging altogether. In general, studies that have tracked progress once active treatment has ended have reported that gains made with CBT are maintained reasonably well. In addition, CBT is associated with reductions in dietary restraint, improved attitudes toward weight and shape, and improvements in mood and self-esteem. Moreover, despite fears about the consequences of eating regularly, the available evidence suggests that the majority of those treated do not gain weight. This is probably because as regular meals come to supplant binges, the

overall number of calories consumed daily decreases or remains largely unchanged.

### Interpersonal Psychotherapy

Like CBT, interpersonal psychotherapy (IPT) has been applied to other psychiatric disorders, particularly major depression. The rationale for IPT in BN is that bulimics typically present with a number of interpersonal problems that may precipitate mood fluctuations and lead to binge/purge behavior. As opposed to CBT, which focuses more directly on the specific eating-related symptoms of BN, IPT focuses much less on eating difficulties and typically targets one among a group of four possible interpersonal problem areas: role transition, interpersonal role disputes, grief, and interpersonal skills deficits. In addition, IPT is a less directive form of psychotherapy than CBT.

As applied to bulimia, IPT is generally carried out over 18-20 sessions with three distinct phases. The initial phase involves review of the individual's past and current relationships as well as a life chronology that identifies relationships among significant life events, mood and self-esteem, interpersonal relationships, and changes in weight. The first phase of treatment culminates in a "life chart" that illustrates the links between particular life experiences and symptoms of bulimia. One of the four problem areas noted above is usually identified as the chief focus of treatment and targeted for change.

The middle phase of treatment is devoted to attempting to resolve issues in the identified problem area. For example, if grief is the area identified, steps would be taken to identify links between the death of a loved one and the bulimic symptoms, facilitate the mourning process, and assist the patient to reestablish new relationships. If a primary problem involved a role transition (e.g., moving away from home to attend college), the steps might include elaborating the meanings associated with the transition, identifying perceived advantages and disadvantages as well as obstacles to making the transition, and practicing skills necessary complete the transition and establish appropriate social supports.

The final treatment phase involves summarizing and solidifying changes that have been made. In addition, a review is undertaken of specific changes in eating behaviors and how these relate to changes in interpersonal patterns.

IPT has been compared to CBT in several trials. In general, the results suggest that IPT is associated with results that are somewhat more modest. Over the short term, compared with CBT, IPT is associated with smaller reductions in binge eating and purging as well as lower rates of abstinence. However, over longer periods of time, IPT appears to "catch up," suggesting that while it may be reasonably effective, compared with CBT a longer period of time is required to bring about maximum improvement.

### Dialectical Behavior Therapy

Dialectical behavior therapy (DBT) was originally developed for those with borderline personality disorder, who often cope with negative emotional experiences with self-mutilation or other self-destructive behavior. DBT specifically aims to facilitate improved affect regulation and tolerance for emotional distress. The rationale for employing DBT for BN is that negative mood frequently precipitates binge/purge episodes and that the latter may serve as a way of escaping from unwelcome emotions. DBT aims to decrease symptoms of bulimia by increasing the individual's ability to modulate strong emotions.

The skills taught in DBT include "mindfulness" or nonjudgmental awareness. This involves decreasing judgment of one's own emotional responses. Other facets of treatment include skills in reducing emotional vulnerability by changing behavior patterns associated with negative emotion. One way of accomplishing the latter involves the use of behavioral chain analysis. With this procedure, problematic behaviors, such as binge/purge episodes, are examined in terms of precipitating events and the detailed sequence of thoughts, sensations, feelings, and behaviors that preceded the episode.

To date, DBT was evaluated in only one trial with bulimics. However, the results were quite promising. The remission rate was close to 30%, and reductions in binge/purge episodes were above 85%. No long-term follow-up data are available at this time.

### ANTIDEPRESSANT MEDICATION

The rationale for the use of antidepressant medications for BN developed from observations that mood disturbances are common among those who have BN. A large number of controlled trials have investigated

the efficacy of a variety of antidepressant medications in reducing the symptoms of BN, including tricyclic antidepressants, monoamine oxidase inhibitors (MAOI), specific serotonin reuptake inhibitors, and others. In general, most of the antidepressant medications tested with bulimics have been found to be significantly superior to placebo. Overall, the reductions in purging are approximately 60% and remissions are approximately 30%.

A number of studies have specifically either compared antidepressants with CBT or investigated whether combining the treatments is more helpful than either alone. Overall, these studies suggest that CBT produces better results than medication alone. There is also evidence that combining the treatments produces modest enhancements in outcome. Little is known about the long-term effectiveness of antidepressant medication.

Interestingly, while antidepressant medications for BN seem to be associated with improvement in mood, there is no relationship between being depressed at the beginning of treatment and improvement in symptoms of BN. That is, whether or not an individual's symptoms of BN reduce with antidepressant medication is unrelated to the level of depression at the beginning of treatment. Thus, why the treatment is helpful remains unclear.

## TREATMENT SETTING

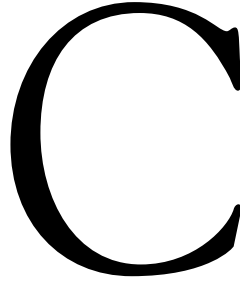
While residential or inpatient treatment is available for those with BN, there is no evidence that it provides benefit over the less expensive outpatient treatments described above. Inpatient treatment is generally appropriate only for those who are at risk for suicide, or develop serious medical problems either as a consequence of bulimia or some other disorder.

—Bruce A. Arnow

See also EATING DISORDERS

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## CANCER AND DIET

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In recent years, there has been an explosion of prospective studies on diet and chronic disease, and this has greatly furthered our understanding of cancer etiology. Much of the hypothesized relation between diet and cancer comes from studies of the variation in cancer rates between countries and the change in both diet and cancer rates when populations migrate from one country to another. Building on international correlation studies and retrospective case-control studies, prospective cohort studies offer the potential to evaluate diet-disease relationships free from recall bias and to correct for measurement error.

Current evidence from these prospective studies suggests that, on a global scale, diet and obesity cause approximately the same proportion of cancers each year as tobacco use does. That is, nearly one third of all cancers (or 3 million to 4 million cases worldwide) are caused by diet and obesity—and could thus be prevented by improvements in nutrition and physical activity. Specifically recommended is a diet rich in plant-based foods and moderate in meat and alcohol. In addition, for cancer prevention and overall health, this diet must be balanced with regular physical activity. Below we summarize the evidence for these recommendations, outlining the specific effects that various foods and nutrients, as well as weight and physical activity, have on cancer risk.

Although diet, weight, and physical activity have been considered in relation to various types of cancer, this review focuses only on associations that are convincing or probable. The weaker possible associations

are not discussed. In order for an association to be considered convincing, there must be consistent epidemiological findings across a large number of well-designed studies, demonstration of a dose-response relationship, a biologically plausible mechanism, and supportive laboratory evidence. Probable associations are those for which there is supportive laboratory or mechanistic evidence, but the epidemiological evidence is inconsistent or not extensive enough to make definitive judgment.

### FOODS

Although scientists can now isolate many of the specific components of foods, it is still important to consider the effect that whole foods have on health. After all, people buy, prepare, and eat whole foods rather than specific nutrients. In addition, despite advances in technology and study methodology, researchers cannot always tell which component of a food is responsible for which risk or benefit. In the instances that they can, it might be unclear whether the component is working alone (and so could be taken as a supplement) or whether it functions only in concert with other ingredients in the food. For example, at one point, vegetables were thought to lower the risk of lung cancer, and beta-carotene was thought to be the main ingredient offering protection. However, when researchers gave beta-carotene supplements to smokers, they found no reduction in the risk of lung cancer. In fact, they found a somewhat elevated risk. This may be because researchers focused on the wrong component of vegetables—or because beta-carotene does not have the same effect on lung cells

when it is taken alone versus with other vitamins and minerals in vegetables. It may also be that a combination of carotenoids is more important than beta-carotene alone. Regardless, this example points to the importance of understanding how both specific nutrients and whole foods affect health.

### Fruits and Vegetables

For many years, the most abundant evidence for an effect of diet on cancer risk was related to fruits and vegetables, with higher intake proposed to lower risk. However, the large majority of this evidence arose from case-control studies, and prospective data have been far less consistent. In fact, prospective cohort studies are supporting fewer and fewer associations between overall fruit and vegetable intake and the risk of cancer. Although once considered convincing, the evidence is now considered only probable for associations between a high intake of fruits and vegetables and cancers of the pancreas, bladder, mouth, pharynx, larynx, esophagus, and stomach.

Although total fruit and vegetable intake may not provide the blanket benefit it was once thought to, researchers are now considering the possibility that specific types of fruits and vegetables might offer protection against certain types of cancer. For example, tomatoes have been proposed to lower the risk of prostate cancer, and green leafy vegetables have been studied in relation to both stomach and lung cancer. However, these relationships—and the many others that are currently being investigated—need further study before they can be considered convincing or even probable.

Numerous mechanisms have been proposed to explain the potential benefits of fruit and vegetables in terms of cancer risk. Most have focused on the effects of specific agents in these foods, such as carotenoids, selenium, folic acid, fiber, and vitamins C and E. However, Steinmetz and Potter (1991) have suggested that fruits and vegetables contain an “anti-carcinogenic cocktail” of substances, including both recognized nutrients and nonnutritive constituents. Together, these substances inhibit the formation of carcinogens, act as substrates for the endogenous production of anticarcinogens, reduce the capacity of transformed cells to proliferate, and act as antioxidants.

Despite the diminishing evidence with respect to cancer, fruits and vegetables are still recommended as part of an overall healthy diet. These foods lower the

risk of hypertension, coronary heart disease, and ischemic stroke, in addition to containing vitamins and minerals that protect against a host of other conditions.

### Red Meat

There is evidence that a high intake of red meat probably increases the risk of colorectal cancer among both men and women. Although not entirely consistent, numerous studies of both cohort and case-control design have reported a positive association between red meat and colon cancer. For most studies showing an association, the increase in risk was about twofold for those consuming the most red meat compared to those consuming the least.

Several mechanisms have been proposed to explain this. First, the specific fatty acid content of red meat may be particularly harmful. However, the fatty acids in beef are not unique and overlap substantially with dairy fat, which is not related to colon cancer. Second, fat from red meat may be less readily digested or absorbed in the small intestine than fat from other sources; therefore, more of it may reach the large bowel. Third, initiators or promoters may be formed when red meat is cooked, particularly at high temperatures. Finally, frequent consumption of red meat may increase concentrations of fecal iron, which could influence the risk of colon cancer via the generation of hydroxyl radicals.

### Alcohol

Because alcohol use tends to be associated with cigarette use and other high-risk behaviors, its independent effects on cancer have long been questioned. However, in 1988, on the basis of abundant epidemiological evidence, the International Agency for Research on Cancer concluded that alcohol is in fact a carcinogen and an independent risk factor for cancers of the upper aerodigestive tract and liver. Since that report, a large body of evidence has confirmed that alcohol use also increases the risk of breast cancer and probably colon and pancreatic cancer.

Although numerous studies have compared the individual effects of beer, wine, and liquor, the type of alcohol consumed does not appear to influence cancer risk as much as the amount. For cancers of the upper aerodigestive tract, breast, colon, and rectum, there is a dose-response relationship, such that even low or

moderate intake (of any type of alcohol) increases risk slightly. For liver cancer, the most important factor is heavy and persistent use, such as that defined by alcoholism.

In contrast to its harmful effects on cancer and other conditions, alcohol has proven benefits in terms of cardiovascular health. Moderate alcohol consumption reduces the risk of death from coronary heart disease by 20% to 40%. Because cardiovascular disease is the leading cause of death in middle age and beyond, a reduction in cardiovascular mortality risk will translate, for many populations, into a reduction in total mortality risk. Clearly, this benefit of alcohol must be balanced with its many risks.

## Nutrients

In addition to whole foods, there is growing evidence that specific macronutrients and micronutrients might also affect cancer risk. Macronutrients are the major nutrients (such as fat, carbohydrates, fiber, and protein) that the body needs in large quantities to function properly. Although there is evidence suggesting possible relationships between a variety of macronutrients and site-specific cancers, more solid evidence exists for only one association: animal fat and prostate cancer. Even this is considered only probable and is still being investigated.

For micronutrients, some stronger links exist, with the most established being between folate and colorectal cancer. A number of studies have found that as folate intake increases, the risk of colorectal cancer (as well as polyps) decreases. The Nurses' Health Study found that a high intake of folate-rich foods, such as fruits and vegetables, was sufficient to lower risk, but that supplementation with a multivitamin that contained folate offered even greater reductions. The underlying biologic role of folate and its interaction with the MTHFR gene add support to the causal relation between low folate and colon cancer. In addition, there is evidence that the risk of colorectal cancer may also be lowered with calcium supplementation.

The association of vitamin A and carotenoids with cancer risk has also been studied extensively, with the strongest evidence supporting a probable link with breast and lung cancers. Currently, however, it seems there is only a small reduction in the risk of breast cancer associated with a high intake of carotenoids. And while a number of observational studies support an association between high carotenoid intake and

lower risk of lung cancer, randomized trials of the carotenoid beta-carotene intake found either no effect or an increased risk of lung cancer.

## PHYSICAL ACTIVITY AND WEIGHT

For overall health, as well as cancer prevention, energy intake (as measured by diet) must be balanced by energy expenditure (as measured by physical activity). Clearly, one's weight is a reflection of that balance: obesity results from a sustained positive energy imbalance and is often a consequence of lifelong inactivity. Although physical activity and weight are related to diet, they are also independently related to cancer risk.

### Physical Activity

High levels of physical activity reduce the risk of colon cancer and breast cancer. Among both men and women, high levels of activity may reduce colon cancer risk by as much as 50%. Although studies have not consistently used a standard measure of physical activity or defined exactly what constitutes a "high" level of activity, an inverse dose-response relationship between activity and colon cancer has been consistently observed across various study designs and populations. Several mechanisms have been proposed to explain this. First, physical activity may speed the passage of stool through the gastrointestinal tract, thereby minimizing contact between the bowel wall and any potential carcinogens in the stool. Second, physical activity may reduce circulating levels of insulin, which is a growth factor for epithelial cells in the colon. Finally, physical activity may alter prostaglandin levels, improve immune function, and modify bile acid metabolism.

Although not entirely consistent, the majority of studies also suggest that physical activity may modestly lower the risk of breast cancer. A woman's risk of breast cancer depends largely on the amount of estrogen circulating in her body, and physical activity can influence this. Long-term activity can reduce levels of circulating ovarian hormones in premenopausal women and can reduce the amount of adipose tissue in postmenopausal women. Adipose tissue is the primary source of estrogen after the ovaries stop producing hormones.

Physical activity in early childhood may also affect breast cancer risk. By interacting with the adrenaline system to reduce levels of circulating estrogens, physical

activity may result in delayed menarche. In addition, young girls who are physically active have less adipose tissue, and this may also delay menarche. Early age at menarche (< 12) is an established risk factor for breast cancer.

## Weight

Epidemiological studies that have assessed the effect of body weight on cancer risk have taken into account a variety of factors related to weight, including dietary intake, physical activity, health status, and hormonal factors. From these studies, there is conclusive evidence that body weight influences the risk of cancers of the endometrium, breast, colon, kidney, and esophagus. Current evidence also suggests a probable relationship between obesity and prostate cancer.

The evidence is most convincing for endometrial cancer, where a positive dose-response relationship has been observed consistently. Risk appears to be particularly elevated among older women who are overweight and among those who experience weight gain during adulthood. Overall, obese women appear to be about twice as likely to develop endometrial cancer as lean women. Similar trends have been observed for breast cancer and are most likely due to the effect of body weight on levels of endogenous estrogens.

In terms of colon cancer, obesity appears to influence the development of adenomatous polyps and the progression of polyps to malignancy. Both men and women with excess body weight are at increased risk of polyps and colorectal cancer, with two large cohort studies suggesting a 50% increase in risk among those who are obese. Although the underlying mechanism for this is not yet known, there is strong evidence supporting a relationship between excess weight and glycemic control. Obesity is related to increased insulin resistance and hyperinsulinemia, which in turn are related to the proliferation of colon cells in laboratory studies. Further evidence supporting this mechanism comes from studies of the insulin-like growth factor (IGF) pathway, which have demonstrated that IGF is directly related to colon cancer risk.

Kidney cancer is another disease influenced by obesity in both men and women. Virtually every study that has examined this relation has observed a positive association, though it is usually stronger among women than men. Although this gender difference has suggested to some that the underlying mechanism may be related to hormonal changes, there is little

epidemiological evidence linking hormone-associated variables with kidney cancer.

Esophageal cancer has also been linked convincingly to body weight. Obesity is a known cause of gastroesophageal reflux, a risk factor for esophageal adenocarcinoma. In a population-based case control study from Sweden, a strong direct relation was observed, with a relative risk of 16 for obese adults compared to lean adults. Other studies have also observed this relation with adenocarcinoma, though the magnitude of effect has been weaker.

In addition to the convincing links described between weight and cancer, there is also evidence of a probable relationship between obesity and prostate cancer mortality. Several studies have suggested that obesity may predispose to more aggressive tumors or, alternatively, that it may foster proliferation of prostate cancer after it has developed. Possible mechanisms involve a range of hormones, including the IGF pathway, insulin itself, and, potentially, androgens.

## CONCLUSION

Diet, combined with obesity and lack of physical activity, contributes substantially to the risk of cancer in the population. Though convincing evidence is often lacking on the link between various components of diet and cancer, enough evidence exists to make some overall recommendations. A prudent, risk-reducing diet—especially when other chronic diseases are considered—should minimize red meat consumption and emphasize plant-based foods, such as fruits, vegetables, and whole grains. And there is growing evidence that taking a multivitamin containing folate may substantially lower cancer risk. Increasing physical activity levels should also have significant benefit, reducing cancer risk through improved glucose metabolism as well as preventing weight gain and its associated cancer risk. As research advances and scientists identify additional components of diet that are related to cancer, new strategies will likely be developed to further reduce the burden of cancer in society.

—Graham A. Colditz, Catherine Tomeo  
Ryan, and Hank Dart

See also CANCER AND PHYSICAL ACTIVITY; CANCER AND SMOKING; CANCER PREVENTION; CANCER: PSYCHOSOCIAL TREATMENT; CANCER SCREENING



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## CANCER AND PHYSICAL ACTIVITY

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Physical activity holds relevance across the cancer control continuum, from prevention to survivorship. Physical activity has been defined as bodily movement produced by skeletal muscle contractions that increase the amount of energy expended over resting metabolic rate (U.S. Department of Health and Human Services, 1996). Current research evidence suggests that physical activity may not only prevent certain cancers from occurring but may also help individuals manage some of the difficulties related to cancer treatments (e.g., physical side effects, poorer quality of life) or help individuals improve their health following treatment for cancer.

Observational studies (i.e., cohort and case-control designs) support the view that regular physical activity can protect against susceptibility to cancers at specific sites, with the strongest evidence for colon and breast cancer (International Agency for Research on Cancer [IARC], 2002; McTiernan, Ulrich, Slate, & Potter, 1998). Cancer *site* refers to the particular tissue or organ in the body where cancer develops. Some of the evidence to support the link between physical activity and cancer risk is drawn from population-based studies conducted in the United States, Europe, and Asia that assess physical activity and track cancer incidence in thousands of individuals over time, or from large-scale case-control studies conducted in the United States, Europe, Asia, and Australia (IARC, 2002; Thune & Furberg, 2001). For example, the Harvard Alumni Study followed over 17,000 men for up to 24 years and found a link between physical activity and cancer risk (Lee, Paffenbarger, & Hsieh, 1991). However, definitive conclusions concerning

the influence of regular physical activity on cancer require studies that are able to more clearly establish a causal relationship between physical activity and cancer. Intervention studies on physical activity and primary prevention of cancer have not been conducted (Thune & Furberg, 2001), and the intervention studies on physical activity following cancer diagnosis are preliminary. The following highlights the current evidence linking physical activity to cancer at various sites, proposed mechanisms for these links, and select methodological challenges that exist when examining the association between physical activity and cancer. (For a more detailed discussion of specific studies, see IARC, 2002.)

## OVERALL CANCER RISK

Overall cancer risk refers to the generalized risk of developing any type of cancer, without specificity in terms of the cancer site (i.e., particular tissue or organs in the body). The evidence for the influence of leisure time (also referred to as recreational) and occupational physical activity on overall cancer incidence or mortality is inconsistent. Some studies find that physical activity is associated with decreased cancer risk, while other studies find no association and a few find a positive association, that is, an increased risk associated with higher levels of physical activity. One explanation for these inconsistent findings is that combining cancers at various sites into an overall index can mask significant relationships between physical activity and cancer at specific sites. That is, when an overall index of cancer occurrence is used as the outcome, strong or consistent effects of physical activity on cancer on a particular site (e.g., colon) may be hidden because the absent, weak, or inconsistent effects of physical activity on cancer at other sites may cancel them out. Because of this potential problem, attention has shifted to the examination of physical activity effects on site-specific cancer risk, rather than overall cancer risk.

In general, the beneficial effects of physical activity on overall cancer incidence or mortality, when observed, tend to be stronger in men than women. However, these observed gender differences may be due to methodological issues rather than a reflection of true differences in the effects of physical activity between men and women. In support of this assertion, relatively consistent associations have been reported between regular physical activity and lower breast

cancer rates (see below). Gender comparisons may be complicated by male-female differences in the overall levels of physical activity, as research has generally found that men tend to be more active than women.

Several physiological factors have been proposed to explain how physical activity can reduce overall cancer risk and/or susceptibility to cancers at various sites. These mechanisms include physical activity-related modifications in nonspecific immune functioning (e.g., increased lymphocytes, natural killer cells, and macrophages), weight maintenance (e.g., reduced body mass index, improved body fat distribution), metabolic regulation (e.g., increased insulin sensitivity, lower plasma triacylglycerol concentrations), and endogenous hormones. For the most part, the nature of the relationships between physiological mechanisms, physical activity, and cancer has only begun to be elucidated.

### Cancers of the Colon and Rectum

Results from studies that have examined physical activity in relation to the risk of colon and rectal cancers combined (usually referred to as colorectal cancer) have been mixed. This may be due, in large part, to differential effects of physical activity on colon and rectal cancers among studies that do not differentiate the two cancer sites. Higher levels of physical activity (measured as leisure time, occupational, or overall activity) have consistently been associated with lower colon cancer incidence in both cohort and case-control studies, even after considering factors that may confound the relationship (e.g., age, gender, diet, smoking behavior, family history, body mass index). It has been estimated that increased physical activity is linked to a 40% reduction in colon cancer risk and that 13% to 14% of colon cancer cases can be attributed to physical inactivity (IARC, 2002). In contrast to colon cancer, the occurrence of rectal cancer tends to be weakly related or unrelated to physical activity.

A leading mechanism proposed to explain how increased physical activity protects against colon cancer (and the weak association of physical activity with rectal cancer) is decreased intestinal or bowel transit time and subsequent reduced exposure of the colon to potential cancer-causing agents in stool. In contrast, rectal exposure to carcinogens in stool is less pronounced and would be less affected by exercise-related decreases in bowel transit time. Exercise-induced changes in other physiologic factors (e.g.,

prostaglandin, insulin, or antioxidant levels) have also been implicated as protective mechanisms responsible for decreased colon cancer risk.

### Breast Cancer

The weight of evidence, albeit mixed, suggests that regular physical activity (measured as leisure time, occupational, or overall activity) may protect against breast cancer incidence. The protective effects of physical activity on breast cancer risk do not diminish even after considering the influence of potential confounding factors (e.g., age, body mass index, diet). Graded dose-response relationships between physical activity and breast cancer also have been documented, with higher levels of physical activity linked to lower breast cancer risk among both premenopausal and postmenopausal women. Increased physical activity has been associated with a 20% to 40% reduction in breast cancer risk on average, and approximately 11% of breast cancer cases are attributable to physical inactivity among postmenopausal women (IARC, 2002).

Physical activity may influence breast cancer incidence through a number of mechanisms. Possible hormone-related explanations for the benefits of increased or regular physical activity on breast cancer risk among premenopausal women include irregular or reduced number of menstrual cycles and delay of age at menarche. These exercise-related changes are thought to decrease overall or lifetime exposure to endogenous hormones (i.e., estrogen and progesterone), a previously established breast cancer risk factor. Among postmenopausal women, increased or regular physical activity may reduce exposure to estrogen concentration by lowering body fat, a main source of estrogen following menopause. Modifications in insulin levels, energy/dietary intake, and immune functioning have also been implicated as important mechanisms in the causal pathway between regular physical activity and reduced breast cancer risk.

### Prostate Cancer

No consistent pattern has been documented in the various observational studies examining the relationship between physical activity and prostate cancer incidence. While endogenous hormone levels (e.g., testosterone) have been proposed as a possible mechanism that may link physical activity and prostate cancer, the currently equivocal findings on the relationship

between physical activity and prostate cancer preclude the ability to consider mechanisms with any degree of confidence.

### Other Types of Cancer

The effects of physical activity on cancers in other sites (e.g., cancer of the lungs, pancreas, testis, bladder, skin [melanoma], lymphatic system [lymphoma], kidneys, brain, ovaries, endometrium, stomach) remain to be determined, due primarily to limited available data and discrepant findings from existing studies. Some preliminary studies indicate that regular physical activity is associated with lower risks of lung and endometrial cancers. However, physical activity may increase the risk of cancer in other parts of the body, such as melanoma (due to increased exposure of the skin to the sun) and testicular cancer (among bicyclists and horseback riders due to site-specific trauma or heat). Still, insufficient data currently exist to produce firm conclusions on the effects of physical activity on cancers specific to these other organs or tissues.

### PHYSICAL ACTIVITY AND CANCER FOLLOWING DIAGNOSIS

Limited data exist on the effects of physical activity following cancer diagnosis. Anticancer treatments (e.g., chemotherapy, radiation therapy) can compromise immune function, produce significant side effects (e.g., fatigue, nausea, anemia), and reduce quality of life. Physical activity may offset these adverse treatment effects. Existing data have provided initial support that regular or increased physical activity can enhance health among cancer patients and survivors by reducing treatment-related side effects (e.g., fatigue, nausea, diarrhea), decreasing pain, bolstering immune function, improving fitness (e.g., strength, flexibility, functional capacity), reducing sleep difficulties, decreasing depression, reducing anxiety, and improving overall quality of life. However, further research is required to verify the robustness of these preliminary findings. Whether physical activity levels influence cancer mortality or recurrence among individuals who have already received treatment for cancer also remains uncertain.

### SELECTED METHODOLOGICAL ISSUES

Several methodological issues must be considered when determining whether physical activity positively

or negatively influences cancer, and distinct methodological issues confront physical activity researchers when examining cancer prevention versus cancer treatment/survivorship. Although not exhaustive, the issues briefly discussed here represent some of the major methodological difficulties facing the physical activity and cancer field.

Measurement of physical activity represents a major methodological challenge in cancer prevention studies. Unreliable or less accurate physical activity assessments can hinder the ability to detect significant relationships between physical activity and cancer at various sites. Cancer prevention studies have typically not employed objective or standardized measures of physical activity, but have instead primarily relied on brief, self-reported assessments of occupational, leisure time/recreational, lifetime, or daily activities. In addition, household activities have typically not been assessed in prior cancer prevention research, creating a possible underestimate of overall activity.

Furthermore, the time course over which physical activity provides protection against cancer can be difficult to assess and determine. The development of cancer is typically chronic in nature, and ascertaining the time period(s) when physical activity can curtail this development needs further elucidation. Assessments of physical activity at only one point in the life span of an individual may be insufficient in gaining an understanding of the role of physical activity in cancer prevention. As noted earlier, aggregation of data on cancers at various sites into a single index can result in misleading conclusions by masking the protective effects of physical activity on cancer at specific sites. The paucity of trials of physical activity and cancer prevention also strongly limits the ability to make conclusions about the causal relationships between physical activity and cancer. Much of the prior research is based on observational designs, which cannot insure against bias or confounding factors to the same degree as experimental or randomized clinical trial designs. Consequently, it is possible that factors other than physical activity may be responsible for the reduction in cancer risk noted in prior observational research. The use of cancer biomarkers and intermediate end points (e.g., colon polyps, breast density, serum sex hormones) within clinical trials may help to more conclusively establish causal pathways between physical activity and cancer.

In contrast to studies of cancer prevention, evaluations of the influences of physical activity following

cancer diagnosis have been more likely to involve more precise measurement of activity (e.g., scheduled exercise sessions), employ experimental designs (e.g., intervention vs. control group comparisons), and evaluate the progression of cancer development. However, the samples of cancer patients and survivors of prior studies tend to be small and may not be representative of other individuals who have been diagnosed with cancer (i.e., convenience samples have largely been utilized). In addition, physical activity interventions are sometimes incorporated within a broader treatment program, making it more difficult to determine the specific contributions of physical activity to cancer-related outcomes. The relatively short duration of most physical activity interventions (generally less than 30 weeks) further limits the ability to determine whether and when physical activity influences health following cancer diagnosis.

## RECOMMENDATIONS TO THE PUBLIC

The International Agency for Research on Cancer/World Health Organization (IARC, 2002) recommends that individuals should engage in at least 30 to 60 minutes of moderate-intensity physical activity (e.g., brisk walking) on most days of the week. Sixty minutes of moderate-intensity physical activity per day may be necessary for healthy weight maintenance, depending on dietary intake patterns, and more vigorous-intensity physical activity may confer additional cancer prevention benefits.

## SUMMARY

On the whole, the current literature suggests that regular or habitual physical activity is associated with reduced cancer risk, particularly with respect to colon and breast cancers. Whether physical activity is related to cancers at other sites remains unclear due to limited research and discrepant findings from existing studies. As future studies endeavor to address some of the methodological challenges noted in the current literature, the strength of the relationships between different patterns of physical activity and cancer prevention, as well as survivorship and quality of life following cancer diagnosis, should become increasingly clear.

—Audie A. Atienza and  
Abby C. King

See also CANCER AND DIET; CANCER AND SMOKING; CANCER PREVENTION; CANCER: PSYCHOSOCIAL TREATMENT; CANCER SCREENING; HARVARD ALUMNI HEALTH STUDY; OBESITY: CAUSES AND CONSEQUENCES

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## CANCER PREVENTION

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Much of human cancer, perhaps half, could be prevented if actions were taken to modify or eliminate human behaviors and environmental factors known to cause cancer. In a landmark 1981 paper, which has stood the test of time, Doll and Peto estimated that the proportion of cancer due to tobacco use was as much as 30%, to dietary factors approximately 35%, to infection 10%, to reproductive and sexual behavior 7%, to occupational exposures 4%, to alcohol 3%, to sunlight 3%, and to pollution, food additives, industrial

products, medicines, and unknown factors the remaining 8%. In 1993, McGinnis and Foege, taking more of a public health perspective, examined the “actual” causes of all deaths in the United States and estimated that over half could be primarily attributed to tobacco and alcohol use, dietary factors, and lack of physical activity, with some contribution from microbial and toxic agents, sexual behavior, illicit drugs, firearms, and motor vehicle accidents. Reflection on the dramatic changes in cancer incidence and mortality over this century also supports the idea that a substantial amount of cancer can be prevented. In the United States, we know with some certainty that mortality from cancer was approximately 80 per 100,000 a hundred years ago, at the beginning of the 20th century. Since then, the death rate from cancer rose steadily to 135 per 100,000 in 1990 but, in a historic reversal, decreased over the decade of the 1990s. Such dramatic short-term changes could not have been due to any alteration in the basic genetic or physiologic makeup of human beings and are unlikely due to changes in medical care. Rather, they must be due to changes in external factors related to human behaviors and the environment (e.g., tobacco use). Additional evidence comes from tracking cancer rates among migrant populations, like the Japanese moving to the United States, where over just a few generations migrants have taken on the cancer rates of their new host countries, while people of the same genetic makeup who stayed home have maintained the rates of the homeland. This is likely due to exposures to new environmental conditions rather than to the differential migration of persons with an increased susceptibility to cancer.

Taking full advantage of what is already known about the causes of cancer can help maintain and accelerate the current downward trend in cancer mortality. First, it is useful to establish what individuals can do to prevent cancer. A personal approach might start with a thorough understanding of one’s family history, which is a combination of inherited genetic susceptibility, lifestyle, and environmental factors. Mutations in genes such as BRCA1 confer about a 70% chance of developing breast cancer sometime in a woman’s life, but because these and other more powerful (highly penetrant) genes are not common, perhaps no more than 5% to 10% of all cancers can be attributed to them. Nevertheless, when a family history of cancer is present, it can give us an idea of which types of cancers we might be susceptible to

ourselves. If, for example, these are cancers known to be due to tobacco, like lung or bladder cancer, it behooves us to make extra efforts to avoid tobacco.

Preventive options for persons with documented inherited genetic susceptibility to cancer from genetic testing are currently limited and involve hard choices. For women with BRCA1 or 2, for example, options include beginning mammography screening at an earlier age and having it more frequently than normally recommended, the use of tamoxifen, and prophylactic mastectomy or oophorectomy. Each of these options is known to confer substantial protection, but each has potential downsides or is unacceptable to some women.

More common (greater than 1% of the population) but weaker (less penetrant) genes are likely to play a larger role in cancer susceptibility through interactions with other genes and the environment. This is an area of active investigation, and no options for incorporating this information into preventive strategies are yet available.

Knowledge of one’s family history of cancer or of specific genetic susceptibility, although potentially useful, should not detract from following many well-established cancer prevention practices that apply to everyone. By far the most important action is to avoid tobacco use or stop it, once begun. Tobacco use should not be considered just another factor in a menu of cancer-causing agents to be avoided. It is *the* factor most responsible for the rise (and fall) of cancer-related deaths over the last century and is currently estimated to account for around a third of all cancer mortality. Individuals usually become addicted to tobacco in adolescence, and we now know that even occasional experimentation with tobacco in the young is sufficient to lead to addiction. The earlier people start smoking, the more likely they are to become addicted long-term users. Thus, a large part of prevention, beyond not starting at all, is to find ways to avoid even experimenting with tobacco as long as possible. For addicted smokers, many cessation strategies are available. For example, nicotine replacement (e.g., patch or gum) can increase the chances of quitting by twofold and is more effective when accompanied by counseling.

Tobacco use is, however, not just an individual problem, but a societal challenge, and some of the most effective interventions are those that involve legislation and government policies. Such actions may include increasing the price through taxation, decreasing

the availability of tobacco products by eliminating vending machines or requiring age-identification for purchase, or restricting advertising of tobacco products. They may also take the form of clean indoor air laws, which are based on evidence that secondary exposure to tobacco smoke can also contribute to cancer.

Evidence of the role of diet in cancer is not as strong as for tobacco, but for those who do not use tobacco (three quarters of adults in the United States), changes in food intake are probably the major personal strategy that can be followed to reduce cancer risk. Studies have consistently shown that diets that routinely include fresh fruits and vegetables are protective for several cancers, including those of the pharynx, larynx, lung, esophagus, stomach, and cervix. In addition, vegetable consumption, but not fruits, may reduce the risk of colon and rectal cancer. Selection of whole grain products such as whole wheat bread or brown rice over refined grain foods and foods high in refined sugars may also be important. Our understanding of the possible contribution of animal protein and fats as causes of cancer is less clear, but the evidence that red meats and processed meats contribute to an increased risk of colorectal cancer is reasonably consistent.

In addition to foods, the avoidance of the regular and heavy use of alcohol can contribute to lowering the risk of several cancers, including breast cancer in women, and oral, esophageal, liver, and laryngeal cancer. At least 3% of all cancers are attributable to alcohol consumption (4% of cancers in men and 2% in women). Alcohol acts synergistically with tobacco use to lead to more cancers than expected from the sum of risks associated with either factor separately.

Other measures under personal control in the prevention of cancer include the regular habit of physical activity and avoidance of overweight and obesity. Higher levels of physical activity have been associated with lower rates of certain cancers, including colorectal and breast. Obesity, defined as a body mass index over 30, has been associated with elevated risks of a large number of specific cancers in both men and women and may account for as much as 14% of all cancer in men and 20% of all cancer in women. The complex interaction of diet, overweight and obesity, and physical activity is one of substantial current investigation.

The avoidance of overexposure to the sun and ultraviolet light is also important, since it is clearly linked to both the common squamous and basal cell

skin cancers as well as to melanoma skin cancer, which can be fatal. Effective means of preventing ultraviolet light exposure include sun avoidance by seeking shade and using protective clothing as well as using sunscreens when in the sun. A false sense of security may reduce the protective effects of sunscreens if time in the sun is unintentionally extended beyond the protection offered.

Beyond personal choices and behaviors, other measures can lead to cancer prevention. Chemoprevention refers to the active use of agents, including pharmaceuticals or micronutrients, that may prevent cancer in various forms. For example, clinical trials have suggested that the use of inhibitors of cyclooxygenases (COX-2 inhibitors), which play a role in inflammation, apoptosis, and angiogenesis, may result in a reduced risk of colorectal and other cancers. Tamoxifen, an antiestrogen, is effective in preventing cancer in the contralateral breast of women who have had estrogen-receptor positive breast cancer as well as preventing cancer in women at high risk of breast cancer. Surprisingly, however, some of the best candidates for nutritional chemoprevention based on observational dietary studies have not proven effective as isolated agents. For example, although fruits and vegetables containing large amounts of carotenoids are protective, a form of vitamin A taken as a pill, beta-carotene, actually increased the risk of lung cancer among smokers. In addition, dietary fiber, which had been protective against colorectal cancers in case-control studies, has not been confirmed as a useful chemopreventive against colorectal adenomas, which are cancer precursors. Nevertheless, chemoprevention is likely to remain an important area of opportunity in cancer prevention. For example, promising trials of the role of selenium, soy protein, and finasteride in prostate cancer are in progress.

Cancer vaccines offer a new hope for the prevention of cancers of viral origin. Liver cancer is one of the most common and fatal cancers worldwide, and hepatitis B is the major causal agent. The chronic carrier state that frequently follows infection in newborn and young children can be prevented with hepatitis B vaccination given as close to birth as possible. In Taiwan, reductions in childhood rates of carcinoma of the liver have been observed since the introduction of the vaccine in 1984, but the results of contemporaneous controlled trials in other highly endemic countries are still awaited. For cervical cancer, a preventive monovalent HPV-16 vaccine against the human papillomavirus

has shown real promise against new, persistent infections in young women. If future studies confirm and expand this result, the impact of preventive vaccines on cervical cancer incidence and, therefore, on the need to rely on Pap smears for early detection, could be substantial in the near future.

What progress can be expected from reductions in occupational exposures to carcinogens and environmental pollution? Concerns about the causes of cancer present in our physical environment and beyond our direct control have become a persistent feature of the cancer prevention landscape. The role of some agents such as asbestos, ionizing radiation, vinyl chloride, benzene, and radon are well documented. To date, a total of 25 chemicals or chemical mixtures have been designated as carcinogens and another 25 as probable carcinogens by the International Agency for Research on Cancer. Yet estimates suggest that environmental toxins and occupational exposures account for no more than 5% to 7% of all cancers. The impetus for seeking regulatory control and elimination of these chemicals is that societies can take direct action to prevent cancer due to these causes and, in principle, no one should sustain risks of cancer from agents to which they are exposed involuntarily. The challenge remains to continuously explore new leads, to construct appropriate environmental protections, and to communicate clearly to the public what is known and yet unknown.

Gradients in overall cancer mortality by socioeconomic status exist in industrialized countries such that those on the bottom of the gradient sustain higher death rates. The understanding of these gradients through study of the role of known cancer risk factors, of health care delivery, and of the relevant biologic pathways is a new area of transdisciplinary research. Once understood, interventions may be developed at critical points in the pathways to cancer, including those at a policy and public health level. For example, we have good evidence that tobacco use can be reduced by changes in clean air laws, the price of tobacco, and efforts to reduce sales to youth.

In conclusion, what we already know can contribute mightily to the prevention of cancer. Many of the actions necessary are behavior or "lifestyle" factors accessible to individuals, but other interventions by health care systems and policies on a societal level can also be effective. Interventions of proven worth in both the clinical and public health setting have been reviewed by the U.S. Preventive Services Task Force

and the U.S. Guide to Community Prevention Services. Further research into the causes of cancer and the means to prevent it will provide more avenues for action in the future, but effective actions are at hand today.

—Robert A. Hiatt

See also CANCER AND DIET; CANCER AND PHYSICAL ACTIVITY; CANCER: PSYCHOSOCIAL TREATMENT; CANCER SCREENING; CANCER AND SMOKING; SMOKING AND NICOTINE DEPENDENCE: INTERVENTIONS; SMOKING PREVENTION AND TOBACCO CONTROL AMONG YOUTH

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## CANCER: PSYCHOSOCIAL TREATMENT

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Although cancer continues to be a significant public health problem, considerable medical progress has been made in treating this set of diseases during the past several decades. Many forms are curable, and there is a sustained decline in the overall death rate from cancer in terms of the impact on the total

population. Because of improvements in medical science, more people are living with cancer than ever before. However, psychosocial and emotional needs are frequently overlooked, and in spite of improved medical prognoses, cancer patients often continue to experience significant emotional distress. For example, compared to the general population, cancer patients experience a fourfold increase in the rate of depression. Other significant psychological problems include pain, anxiety, suicide, delirium, body image difficulties, and sexual dysfunctions. Even for people who historically have coped well with major negative life events, cancer and its treatment greatly increase the stressful nature of even routine daily tasks.

In response to these significant negative psychosocial consequences, a variety of psychosocial interventions have been developed to improve the quality of life of cancer patients and impact positively on their psychological distress. Such approaches include educational interventions, cognitive-behavioral strategies, and group therapy approaches.

## EDUCATIONAL INTERVENTIONS

The major goal of educational interventions is to reduce cancer patients' distress and improve their sense of control that may be engendered by lack of knowledge and feelings of uncertainty. Patient education programs have involved a variety of venues, including written materials, films, audiotapes, videotapes, and lectures. The topics covered include technical aspects of the disease and its treatment, potential side effects, navigating the medical system, and the physician-patient relationship. Scientific evaluations of such methods report beneficial effects, such as decreases in depression and anxiety and increases in knowledge about cancer.

## COGNITIVE-BEHAVIORAL INTERVENTIONS

Cognitive-behavioral therapy (CBT) is an empirical approach that focuses on the interrelationships between behavior, thoughts, emotions, and biological events regarding mental health problems and medical symptom development and persistence. CBT, in this context, incorporates a wide array of intervention strategies that attempt to change those behavioral, cognitive, and affective variables that mediate the negative effects of cancer and its treatment. Many strategies under the CBT umbrella are theoretically based

on principles of respondent and operant conditioning, such as contingency management (e.g., changing the consequences of behavior to change the behavior), biofeedback, relaxation training, and systematic desensitization, whereas other strategies are more cognitive in nature and include techniques such as cognitive distraction, cognitive restructuring, guided imagery, and problem-solving therapy. Applications of CBT for cancer patients have addressed both specific negative symptoms (e.g., anticipatory nausea, pain), as well as overall distress and quality of life.

*CBT for anticipatory nausea.* Clinically, a negative side effect of chemotherapy is anticipatory nausea and vomiting. From a respondent conditioning conceptualization, this occurs when previously neutral stimuli (e.g., smells, colors, and sounds associated with the treatment room) acquire nausea-eliciting properties due to repeated association with chemotherapy treatments and its negative aftereffects. Investigations conducted in the early 1980s found various CBT approaches (e.g., progressive muscle relaxation combined with guided imagery, systematic desensitization) to be effective in reducing anticipatory nausea and vomiting. Systematic desensitization is a procedure whereby over repeated pairings of anxiety-provoking stimuli with a relaxation-inducing response, such stimuli lose their anxiety-engendering properties as feelings of relaxation, rather than tension, become associated with such events.

*CBT for pain.* Although conflicting evidence exists regarding their efficacy, CBT strategies that have been applied to reduce cancer-related pain include relaxation, guided imagery and distraction, and cognitive coping and restructuring. Cognitive coping and restructuring strategies teach individuals to change those negative thoughts and beliefs (e.g., "I'll never get better," "This is the absolute worst thing that can happen to me!") that evoke or intensify negative stressful reactions, such as pain and distress.

*CBT for emotional distress.* The majority of scientific investigations involving CBT interventions with cancer patients tend to address general goals of decreasing their psychological distress and improving their overall quality of life. For example, behavioral stress management strategies (e.g., relaxation training, guided imagery) have been found to be especially effective in achieving such goals. Guided imagery is a CBT strategy that provides structured means of focusing on pleasant (e.g., favorite vacation place) or mastery (e.g., scenes of successfully coping with distress)



images as a means of fostering a relaxation response. Moreover, multicomponent CBT protocols (i.e., combining several different CBT techniques) tend to be the norm. As an example, one seminal study conducted by psychiatrist Fawzy Fawzy and his colleagues included patients who were newly diagnosed with malignant melanoma. This 6-week intervention was comprised of four components: health education, behavioral stress management, problem-solving training, and group support. Six months after treatment ended, patients receiving this treatment program reported significantly lower levels of psychological distress. In addition, 5 years posttreatment, treated patients continued to show significantly lower levels of anxiety, depression, and total mood disturbance.

CBT-oriented interventions have also included family members in treatment as a means of enhancing the positive effects of this intervention. For example, Art and Chris Nezu, cognitive-behavioral clinical psychologists, and their colleagues provided training in problem-solving skills to cancer patients along with their family caregivers (e.g., spouse, adult son or daughter). Problem-solving therapy helps individuals to better cope with stressful life events by improving their ability to be optimistic, identify why situations are problems, generate a variety of possible solutions, make effective decisions as to which solutions to carry out, and monitor the consequences of implemented solutions. In this study, investigators found that including a significant other fostered improved well-being above and beyond the positive effects of problem-solving therapy alone.

## GROUP THERAPY APPROACHES

The potential strengths of group psychotherapy for cancer patients are threefold: (1) it can provide for a milieu in which people with similar experiences can provide emotional support to each other, (2) it is cost-effective for the patient, and (3) it is time-efficient for the mental health professional. However, research evaluating these approaches has provided limited evidence for their efficacy in reducing distress and improving psychological adjustment for cancer patients. Furthermore, the empirical literature suggests that group therapy programs that focus primarily on providing peer support and emphasize the shared expression of emotions are less effective than either educational protocols or programs teaching coping skills.

One seminal study in support of a “supportive-expressive” group therapy approach was conducted by David Spiegel, a psychiatrist, and his colleagues. Their investigation included women with metastatic breast cancer who participated in weekly group therapy sessions that fostered supportive interactions among the participants, encouragement to express one’s emotions, and discussion of cancer-related problems. Close to a year after treatment began, these cancer patients reported significantly less anxiety, depression, confusion, and fatigue, as well as fewer phobias and less maladaptive coping responses.

## EFFECTS OF PSYCHOSOCIAL INTERVENTIONS ON HEALTH OUTCOME

In addition to assessing the effects of psychosocial interventions on psychosocial variables (e.g., emotional distress), investigators have also been interested in whether such interventions have any impact on health outcome; for example, do they actually affect the course or prognosis of the disease? This interest emanates from other research demonstrating that certain psychosocial variables, such as effective coping and positive social support, have been found to be associated with enhanced survival. Psychosocial treatments may affect the course of cancer by (a) improving patient self-care (e.g., reducing behavioral risk factors), (b) increasing patients’ compliance with medical treatment, and (c) influencing disease resistance regarding certain biological pathways, such as the immune system.

To date, the literature providing answers to this question remains equivocal, that is, some studies provide data supporting the notion that psychosocial interventions extend the life of cancer patients, whereas other investigations found no effect on survival. In addition to conflicting evidence, the existence of scientific problems across many of these types of investigations further add to the tentativeness of any firm conclusions in answering this question.

## EFFECTS OF PSYCHOSOCIAL INTERVENTIONS ON IMMUNE FUNCTIONING

One possible mediator of the positive effects of psychosocial interventions on improved health, as well as emotional well-being, is the immune system. In part, support for this hypothesis emanates from research showing changes in certain measures of

immune functioning in humans experiencing stressful events, as well as studies demonstrating changes in immune functioning as a result of receiving psychosocial treatment. For example, psychological-based interventions have been found to increase large granular lymphocytes, natural killer cells, and white blood cell numbers, all markers of improved immune functioning. Although research investigating the link between immunologic parameters and psychosocial variables in cancer patients is in its nascent stage, and therefore can only be viewed as suggestive in nature at this time, such a framework provides for one exciting area for future research and a possible means of explaining one pathway between behavioral factors and cancer-related health outcome.

## PREVENTION ISSUES

The above interventions have addressed goals of improved health and mental health factors *after* a person is diagnosed with cancer. However, treatment strategies can also affect behavioral risk factors, thus attempting to *prevent* cancer. Some of the cancer-related behavioral risk factors include smoking, alcohol, diet, and sun exposure. Overviews of the treatment literature concerning some of these behaviors are contained in other sections of this encyclopedia and therefore are not repeated here. With regard to sun exposure, some interventions have led to increased knowledge of skin cancer and awareness of protective measures; however, programs have had only limited success with increasing preventive behaviors in at-risk groups.

Prevention strategies are also important for individuals considered at high risk due to genetic and familial factors. For example, a positive family history of breast cancer is an important risk factor for breast cancer in women. As such, first-degree relatives of women with breast cancer may also be at risk for psychological distress. With this in mind, investigators have successfully developed programs to reduce this distress and to increase the rate of mammography testing among this group.

## SUMMARY

Overall, research has amply demonstrated that a variety of psychosocial interventions are effective in reducing specific cancer-related physical (e.g., pain, nausea, and vomiting) and emotional (e.g., depression,

anxiety) symptoms, as well as enhancing the overall quality of life of cancer patients. Such treatment programs include educational interventions, a wide array of cognitive-behavioral interventions, and group psychotherapy programs. Among these various approaches, CBT interventions have been more often the focus of scientific investigations and thus have tended to emerge as the more effective and versatile overall therapeutic approach.

In addition to improving cancer patients' emotional well-being, research suggests that psychosocial interventions can also lead to improved survival by affecting the course of the cancer itself. One biological pathway that has been identified as a potential mechanism by which this can occur is the immune system. However, additional studies have noted a lack of an effect on survival rates as a function of participating in psychosocial treatment. Moreover, the literature providing evidence to support a link between behavioral variables and health outcome as mediated by the immune system is only in its infancy with regard to cancer. Therefore, substantial additional research is necessary before the nature of these relationships can be clearly elucidated.

Psychosocial interventions have also been developed for at-risk groups (e.g., first-degree relative of a woman with breast cancer) or people engaging in risky cancer-engendering behaviors (e.g., excessive sun exposure) as a means of reducing risk and preventing cancer.

—Arthur M. Nezu and Christine Maguth Nezu

See also CANCER AND DIET; CANCER AND PHYSICAL ACTIVITY; CANCER PREVENTION; CANCER AND SMOKING; CANCER SCREENING

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## CANCER SCREENING

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Cancer is evident in virtually every country of the world, with developed countries having a greater incidence of disease than nondeveloped countries. The American Cancer Society reports that in the United States alone, cancer accounts for one in four deaths every year, with mortality rates being disproportionately high among ethnic minority populations. The aim of screening is to detect the presence of disease in asymptomatic individuals, thus managing the disease at a more treatable stage. Cancer mortality rates in this country have been considerably reduced with the advent of effective early detection screening regimens, notably mammography for women 50 years and older (breast cancer), Pap smears (cervical cancer), and fecal occult blood testing (FOBT; colorectal cancer). These types of established screening guidelines have frequently been implemented after extensive debate regarding whether screening would prolong life among specific populations (e.g., mammography in women under 50 years of age). Currently, the utility of a number of other procedures is under investigation, including prostate specific antigen (PSA; prostate cancer), CA125 and transvaginal ultrasound (ovarian cancer), flexible sigmoidoscopy and colonoscopy (colorectal cancer), and spiral computed tomography (spiral CT; lung cancer). While the ultimate utility of screening is unclear, it remains the only feasible and recommended population-based approach for early cancer detection.

Effective screening calls for long-term adherence to recommended guidelines over the life cycle. However, there are a number of extrinsic and intrinsic factors that influence cancer screening behaviors and may serve as barriers to sustained adherence. From the extrinsic perspective, access to care is the major determinant of screening attendance, particularly among low-income, ethnic minority, elderly, and rural populations. Inadequate or no health care insurance, geographic isolation, lack of transportation and child care, and availability of medical interpretation services for non-English-speaking individuals are important

barriers to care. A number of intervention approaches have been implemented that directly address access-related barriers to screening attendance. Programs that improve access to screening facilities (e.g., mobile screening services, provision of child care assistance, transportation to screening units), minimize language barriers, and provide culturally sensitive services have proven effective in enhancing screening utilization.

However, while interventions to enhance access have been shown to improve screening adherence, in many cases the barriers to adherence are also centrally related to factors intrinsic to the individual, namely psychosocial factors, particularly over the long term. We now review the psychosocial factors influencing screening adherence and discuss the importance of targeted psychosocial intervention protocols, tailored to assess and address these barriers, in promoting sustained screening adherence.

### PSYCHOLOGICAL FACTORS INFLUENCING SCREENING ADHERENCE

The Cognitive-Social Health Information Processing (C-SHIP) model provides a framework for understanding the cognitive, emotional, and social factors that influence cancer screening behaviors. According to the cognitive-social model, key determinants of cancer screening behaviors include the individual's (a) cancer-related knowledge and perceptions of cancer vulnerability, (b) expectancies and beliefs about cancer risk and available courses of action, (c) health-related values and goals, (d) cancer-related distress, and (e) coping skills for managing distress and generating action plans for adherence to screening and follow-up health-protective behaviors.

#### Cancer-Related Knowledge and Risk Perceptions

Reluctance to participate in cancer screening programs is related, first and foremost, to lack of cancer awareness. Lack of knowledge about the etiology of cancer and available screening options is widespread among both average-risk and high-risk populations. Groups showing particularly low rates of cancer screening, including lower income, less educated, rural, and inadequately insured individuals (such as Native Americans, African Americans, Hispanics, the elderly), show particularly low levels of cancer-related knowledge.

Inaccuracies in knowledge are associated with misperceptions about one's cancer risk. Studies show that

some individuals consistently underestimate their risk for cancer, while others overestimate their risk. Furthermore, subjective risk perceptions tend to vary with cancer type. In particular, men at risk for prostate cancer tend to underestimate their risk, whereas women at risk for breast cancer tend to overestimate their risk. Risk perceptions also vary according to the way in which they are measured (e.g., as an estimate of the percentage lifetime likelihood of developing cancer, ranging from 0% to 100%, or as a Likert scale, ranging from very low likelihood of developing the disease to very high). Not surprisingly, subjective risk levels show a poor correlation with objective risk levels.

### Cancer-Related Expectancies and Beliefs

Perceived benefits (i.e., pros) and limitations (i.e., cons) about cancer screening are associated with adherence. When the expected pros of cancer screening are emphasized (as when the physician recommends the screening procedure), participation rates are increased. Hence, screening rates are higher (although still less than optimal) in cases where there are clear consensus guidelines (e.g., mammography, Pap smear, and FOBT), and lower where consensus guidelines are not clearly established (e.g., PSA for prostate cancer, skin cancer screening). In addition, ambivalent attitudes toward screening utilization among providers and consumers tend to act as barriers to adherence, and may relate to the public debates that have taken place about the efficacy of these procedures. Rates of adherence may also depend on the individual's level of objective cancer risk, such that increased risk leads to increased screening utilization, most likely as a result of greater physician advice.

Conversely, perceived barriers (e.g., negative beliefs about the efficacy or aversiveness of the diagnostic procedure) have been consistently associated with reduced screening adherence. For example, screening adherence rates are lower in cases where the procedures are either unpleasant or associated with discomfort (e.g., FOBT, sigmoidoscopy and colonoscopy for colorectal cancer screening). A related expectancy factor, perceived lack of confidence to perform the procedure, is also associated with low levels of screening adherence, particularly in the case of self-examination procedures that require the individual to personally execute the behavior (e.g., skin self-examination and breast self-examination).

An interesting finding is that cancer screening and diagnostic follow-up adherence among elderly

individuals is considerably lower than for their younger counterparts. Given that the efficacy of widely used screening methods, such as mammography, has not yet been determined for individuals over the age of 65, uncertainty about the efficacy of cancer screening among physicians and patients may contribute to lower adherence among this age group.

### Cancer-Related Values and Goals

Cancer-related values include fatalistic beliefs (i.e., believing, for instance, that there is no use in getting screened, since cancer is inevitable). These types of beliefs are prevalent among ethnic minorities, particularly those who are lower income, less well-educated, and unemployed. Individuals with greater fatalistic beliefs report significantly lower levels of adherence to cancer screening. Furthermore, culturally specific values associated with shame, preferences for non-Western medicine, and mistrust of health professionals have been identified as barriers to cancer screening adherence. These types of shared cultural values tend to reduce expectations about the utility of cancer screening, thereby reducing the motivation for an individual to adhere to these recommendations over the long term.

Certain shared cultural values appear to have a beneficial effect on cancer screening behaviors. Joan Bloom, from the University of California, reports that family members can support screening behaviors by acting as a cultural symbol of the reason to stay healthy. The family's support of the individual's attempts to maintain recommended cancer screening regimens is especially important among cultures placing a high value on interdependence, and most evident for initial cancer screening and highly invasive tests (e.g., sigmoidoscopy). Thus, appealing to family membership may be an effective means of facilitating cancer screening adherence among highly interdependent families, particularly in the case of unfamiliar or uncomfortable tests.

Media exposure represents an additional factor likely to directly influence shared screening-related values and goals and, hence, screening adherence. Breast and cervical cancer screening (which are associated with better adherence) have received a high degree of media attention over the last few decades, but colorectal cancer screening (which is associated with poorer adherence) has received little publicity.

### Cancer-Related Distress

Cancer-related distress refers to the situation-specific (i.e., state) anxiety, worry, and intrusive thoughts that may arise in response to a cancer threat. The effect of cancer-related distress on screening adherence differs according to the level of distress experienced. In the case of low levels of worry, cancer-related concerns are not activated, so there is no motivation for initiating and sustaining screening behaviors. For example, low levels of cancer worry among the elderly, who tend to believe they are no longer vulnerable to cancer, have been linked with poor screening adherence. In contrast, in the case of high levels of worry, excessive anxiety activates avoidance that can undermine the individual's intentions to adhere to recommended screening regimens. For example, among ethnic minorities, fear of cancer is reported as one of the most important reasons for not participating in screening programs and for not attending diagnostic follow-up (e.g., colorectal, cervical). Fear of the procedure itself also undermines screening and follow-up diagnostic adherence, particularly concerns and fears about the iatrogenic effects of biopsies and repeat x-rays among individuals recalled for further diagnostic investigations.

Research by Suzanne Miller and colleagues at Fox Chase Cancer Center in a number of cancer-risk contexts indicates that individuals need to be made sufficiently aware of the cancer threat to motivate them to participate in screening regimens, but should not become so anxious that they actively avoid screening participation. Fear of cancer should also be contained so that it does not lead to overuse of screening, as in the case of excessive performance of breast cancer self-examination that is sometimes found among high-risk women.

### CANCER-RELATED SELF-REGULATORY SKILLS

To effectively adhere to cancer screening regimens, individuals must be able to manage cancer risk-related distress and to develop specific action plans for carrying out health-related behaviors (e.g., scheduling an annual cancer screening examination). Individuals who prefer one form of cancer screening and who generally have health-protective behaviors (e.g., exercise, healthy eating, cholesterol check) appear to be more likely to participate in other forms of cancer screening. This pattern suggests that the individual

has available a general set of self-regulatory skills for managing cancer- and disease-related distress and for executing effective action scripts for maintaining recommended health-protective behaviors.

Consistent with this analysis, screening adherence is influenced by the type of procedure, that is, medical examination regimen versus self-examination regimen. Medical examination is carried out by medical practitioners, and includes direct observation (e.g., skin, cervix), palpation for detecting lumps or tumors (e.g., breast, prostate, rectum), and procedures such as endoscopy, x-rays, magnetic resonance imaging (MRI), or ultrasound for internal cancers (e.g., stomach, colorectal). In contrast, self-examination is performed by the individual and includes direct observation (e.g., skin cancer check) and palpation (e.g., breast self-examination).

For individuals to effectively carry out self-examination procedures, they must have in place strategies for managing cancer risk-related distress and for developing specific action plans for carrying out the required health-related behaviors. Not surprisingly, adherence rates are highest for procedures that are based solely on medical examination procedures (e.g., Pap smear and mammography), and thereby require relatively fewer self-regulatory skills. In contrast, rates are lowest for procedures that require the individual to enact and sustain the behavior (e.g., for colon cancer, since the individual must collect three separate fecal specimens for laboratory analysis). This differential pattern of adherence is also evident within a particular cancer type. For example, adherence to mammography and clinical breast examination (procedures conducted by a medical professional) far exceed adherence rates to breast self-examination (a self-initiated screening procedure).

### PSYCHOSOCIAL INTERVENTIONS TO FACILITATE CANCER SCREENING ADHERENCE

In sum, the effectiveness of cancer screening regimens rests upon long-term adherence. However, even among well-established cancer screening regimens (e.g., breast, cervical), adherence is less than ideal. Effective screening adherence requires that individuals be knowledgeable about their cancer screening options, believe that the pros of cancer screening outweigh the cons, have values consistent with the belief that cancer screening is a useful tool for reducing cancer mortality, and have a moderate level of cancer-related

distress and perceived vulnerability sufficient to maintain (but not overwhelm) self-regulatory strategies for long-term adherence. In addition to improving access to care, these psychosocial factors need to be taken into account in a coordinated fashion when designing interventions to promote performance of cancer screening behaviors.

The most effective intervention protocols are those that are carefully targeted to the specific audience (e.g., ethnic or cultural group), and systematically tailored to the individual's profile of cognitions and affects that become activated in the processing of cancer-relevant information. The use of preparatory counseling strategies that assess and address cognitive-affective barriers to diagnostic follow-up adherence has been found to be beneficial in enhancing participation in several cancer screening contexts (e.g., prostate, cervical, breast). For example, research conducted by Suzanne Miller and colleagues has explored the utility of a tailored preappointment telephone counseling intervention targeted to low-income minority women who need to undergo diagnostic follow-up following notification of an abnormal Pap smear. The counseling intervention addressed the individual's cognitive (i.e., inadequate knowledge, misperceptions of risk, inaccurate expectancies), affective (i.e., distress levels, anticipated discomfort), and self-regulatory (i.e., poor planning) barriers to adherence. Patients who received telephone counseling displayed significantly higher adherence rates to the initial follow-up screening appointment after feedback of the abnormal test result in comparison with patients who received a telephone appointment reminder call and in comparison with usual care. Furthermore, the effects of the intervention were not only evident in the short term but were also sustained over the long term (i.e., at the 6-month follow-up screening appointment). In addition to traditional counseling approaches (e.g., telephone counseling, print materials), recent technological developments will allow for the development of especially promising innovative approaches to enhancing screening adherence through the use of new media approaches (e.g., interactive Internet- and CD-ROM-based interventions).

A key factor that needs to be considered when designing intervention protocols is the role of stable, preexisting individual differences in the pattern of response to health-related information. According to the cognitive-social model, individuals are characterized by distinctive cognitive-affective signatures that determine their characteristic profile of responses to

cancer risk feedback. High monitors (who typically attend to and scan for health-related messages) are more likely to respond to health threats with heightened perceptions of their own vulnerability, greater risk-related distress, and poorer management of anxiety. In contrast, low monitors (who distract from and ignore health-related messages) are more likely to demonstrate inadequate cancer-related knowledge, lowered risk perceptions, and poor planning. These two response styles have implications for the design of tailored counseling and communication messages. High monitors fare better with voluminous information that reduces uncertainty, promotes reassurance, and manages risk-related distress. Low monitors, on the other hand, benefit most from interventions that increase the salience of threat and provide cues and prompts for action.

## SUMMARY

In spite of recent technological advances in cancer control, adherence to available cancer screening regimens continues to fall below optimal levels. Barriers to adherence include lack of access to care, cognitive factors (i.e., cancer-related knowledge, perceived vulnerability, expectancies and beliefs about cancer risk and available courses of action), social factors (i.e., cancer-related values and goals), and affective factors (i.e., cancer-related distress and self-regulatory strategies to manage distress and to execute effective action scripts for maintaining screening recommendations over the long-term). Psychosocial interventions carefully targeted to the population group and tailored to the unique cognitive-affective profile and response style of the individual, combined with access-enhancing approaches, appear most promising.

—Suzanne M. Miller and Kerry A. Sherman

*See also* ADHERENCE TO TREATMENT REGIMENS; CANCER AND DIET; CANCER AND PHYSICAL ACTIVITY; CANCER PREVENTION; CANCER: PSYCHOSOCIAL TREATMENT; CANCER AND SMOKING

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## CANCER AND SMOKING

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Tobacco use is the largest preventable cause of cancer death in developed countries and is responsible for approximately 30% of the cancer mortality that occurs in the United States. Cigarette smoking, in contrast to other forms of tobacco use, developed largely during the 20th century, and it is cigarette smoking that is responsible for the epidemic of lung cancer that began during the 1930s and continues into the new millennium. Cigarette smoking currently causes more than three quarters of the cancer of the lung, oral cavity, larynx, and esophagus in the United States, and it is also responsible for approximately one third to one half of the cancer of the kidney, urinary bladder, and pancreas. Of the cancers caused by cigarette smoking, lung cancer is responsible for the majority of the cancer deaths and is the largest cause of cancer death in both males and females.

Continued investigation of the relationship between cigarette smoking and cancer has produced evidence of a causal relationship between cigarette smoking and cancers of the stomach, cervix, and acute myeloid leukemia. Evidence also suggests that there may be a modest increased risk of colorectal cancer and cancer of the liver. Cigarette smoking does not appear to increase the risk of cancer of the breast. Cigarette smokers have lower rates of endometrial cancer, but the effect seems to be limited to postmenopausal women.

Tobacco smoke is a complex aerosol with more than 4,800 individual constituents, of which at least 58

have been identified as carcinogenic. Most of the carcinogenic effects of tobacco smoke are contained in the particulate phase of cigarette smoke. The small particle size of the smoke aerosol leads to extensive deposition of smoke particles in the airways and alveoli of the lung. Dysplastic and metaplastic changes are commonly present in the cells lining the airways of long-term cigarette smokers, and the extent of these changes are correlated with the intensity and duration of smoking behavior. Similar changes have also been noted in the larynx. The polycyclic aromatic hydrocarbon and tobacco specific nitrosamine carcinogens in smoke form DNA adducts that lead to persistent miscoding during replication. Miscoding errors occur as mutations in genes critical for tumor suppression and lead to the formation of oncogenes. Continued accumulation of molecularbiologic injury over time in long-term smokers can ultimately transform normal cells into a malignancy.

The risk of developing cancer from cigarette smoking increases with the intensity and duration of the smoking behavior, with duration having a more powerful effect on risk. Approximately 40% of persistent cigarette smokers will die prematurely due to smoking-induced disease, and, among heavy smokers, more than 25% are likely to die of a smoking-induced malignancy.

There is little evidence that nicotine by itself is carcinogenic, but nicotine is addictive for most cigarette smokers, and the carcinogenic constituents in tobacco tar are an obligatory companion to the dose of nicotine needed by smokers to satisfy their addiction. Nicotine addiction is manifest by a need for repetitive dosing throughout the day. Once established, the pattern of smoking frequency is a relatively consistent number of cigarettes smoked per day for individual smokers, but the number of cigarettes smoked per day varies widely across the population of smokers, leading to a substantial variation in the cancer risk among individual smokers.

Cancer risks from smoking pipes and cigars are similar to those of cigarette smokers for cancers of the oral cavity and larynx, but the risks for lung cancer are much lower. This difference is likely a result of differences in extent of inhalation with use of these different forms of tobacco. The more alkaline smoke generated by burning pipe and cigar tobacco allows nicotine to be easily absorbed across the oral mucosa, and smokers who have used only these products tend not to inhale smoke into the lung. The more acidic smoke from cigarette tobacco protonates the nicotine, making oral absorption more difficult. Cigarette smoke must then be inhaled into the larger absorptive

surface of the lung in order for substantial amounts of nicotine to be absorbed, and this leads the vast majority of cigarette smokers to inhale the smoke. Unfortunately, cigarette smokers who switch to smoking cigars are likely to continue inhaling, negating any potential benefit of switching.

The addition of filters to cigarettes, and other changes that have lowered the machine-measured yield of tar and nicotine, were expected to reduce the risk of smoking by reducing the exposure of smokers to smoke. However, smokers compensate for the reduced nicotine delivery of these cigarettes by increasing the size and intensity of their puffing on the cigarette and by smoking more cigarettes per day, negating any potential reduction in smoke exposure from so-called lower tar products. Risks of developing cancer do not differ by type of cigarette smoked. The evidence does not support a recommendation that smokers shift to smoking cigarettes with lower machine-measured yields of tar and nicotine as a means of reducing cancer risk, and such a recommendation can cause harm if it misleads smokers to postpone serious efforts at cessation.

Cessation of cigarette smoking reduces the risk of developing cancer in comparison to continuing to smoke. Manifestation of this risk reduction is delayed by one or more years due to the interval between malignant transformation at the cellular level and the time when a cancer is first clinically detected. Cessation of cigarette smoking will reduce the rate of malignant transformation but has less effect on the likelihood of a cancer being clinically detected once malignant transformation has occurred. Growth from a single cancer cell to a clinically detectable cancer may take several years, and it is only after these cancers have been detected that a reduction in the rate of malignant transformation will translate into a reduction in cancer incidence or death rates.

Lung cancer rates fall to approximately one half of the rates of continuing smokers after approximately 10 years of abstinence, and they continue to fall as the duration of abstinence becomes longer. However, even after 20 years of abstinence from smoking, lung cancer risks remain about twice those of individuals who have never smoked.

—David M. Burns

See also CANCER AND DIET; CANCER AND PHYSICAL ACTIVITY; CANCER PREVENTION; CANCER: PSYCHOSOCIAL TREATMENT; CANCER SCREENING

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## CARDIAC REHABILITATION

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Cardiac rehabilitation refers to the process of providing exercise training, medical management for coronary risk factors, and psychosocial interventions for individuals who have cardiovascular disease. Persons eligible are those who have had a heart attack, heart surgery, or other invasive heart procedures such as coronary artery stenting. In addition, persons with congestive heart failure, arrhythmias, implantable defibrillators, valvular heart disease, or peripheral vascular disease qualify for these services. Cardiac rehabilitation programs were first developed in the 1950s when it became apparent that hospitalization for 2 weeks or longer, which at the time was considered necessary for patients who had had heart attacks, led to significant physical deconditioning. The early rehabilitation programs started in the hospital and then continued in community-based group programs or at home. Concern about the safety of unsupervised exercise after discharge led to the development of hospital-based programs, usually supervised by physicians and specially trained coronary care



nurses. Hospital-based programs usually included electrocardiographic monitoring of the patients during exercise.

Hospitalization for heart disease, including bypass surgery, stenting procedures, and other invasive therapies, has now been shortened to 3 to 5 days, resulting in minimal physical deconditioning. However, significant evidence has shown that regular exercise, modification of diet, cessation of tobacco use, and the use of medications to reduce serum lipids, blood pressure, clot formation, and stress on the heart significantly reduce the chance of future cardiovascular events in patients who have heart disease. Cardiac rehabilitation services are critical in filling this important role of education and clinical monitoring. Other evidence suggests that depression and other psychosocial factors, such as sustained anger and hostility and social isolation, may increase the risk of subsequent heart attacks in patients with heart disease. Cardiac rehabilitation programs are ideal settings in which to provide both short- and long-term psychosocial interventions. Cardiac rehabilitation programs also play a role in preparing patients for return to work and resumption of sexual activity.

## GUIDELINES

In recognition of these potential contributions to rehabilitation, in 1994 the Agency for Health Care Policy and Research (now called the Agency for Healthcare Research and Quality), the nation's leading federal agency for research on health care quality, costs, outcomes, and patient safety, convened a group of experts to critically review the scientific literature with the goal of developing evidence-based clinical practice guidelines for cardiac rehabilitation. The report recommended that cardiac rehabilitation programs should consist of multifaceted and multidisciplinary approaches to overall cardiovascular risk reduction and that programs that consist of exercise training alone are not considered cardiac rehabilitation. More recently, the American Heart Association and the American Association of Cardiovascular and Pulmonary Rehabilitation (AHA/AACVPR) stated that all cardiac rehabilitation/secondary prevention programs should contain specific core components that aim to optimize cardiovascular risk reduction, foster health behaviors and compliance to these behaviors, and promote an active lifestyle for patients with cardiovascular disease. The conclusions and recommendations were derived

from an extensive and critical review of the scientific literature pertaining to cardiac rehabilitation, as well as from the expert opinions of the panel.

The need for cardiac rehabilitation is substantial. In 1997, acute myocardial infarction (MI) was diagnosed in over a million people in the United States, and 800,000 patients underwent coronary artery bypass surgery. An estimated 13.5 million U.S. citizens have heart disease, many of whom are severely limited by their symptoms. Yet less than 20% of appropriate candidates in the United States currently participate in formal programs. The data for women and minorities suggest that individuals are even less likely to be referred and/or participate.

## Exercise

Two main symptoms of coronary heart disease, chest discomfort and shortness of breath on exercise, are related to a number of factors, including the extent of coronary atherosclerosis and the presence and/or extent of permanent myocardial damage. When the demand for oxygen in the heart muscle is greater than the supply, worsened symptoms or even new heart attacks can occur. Cardiac rehabilitation programs have developed methods, such as use of symptom-limited exercise treadmill testing, to determine safe exercise limits for patients. Treadmill testing involves challenging a patient with an increasing workload on a treadmill (or a stationary bicycle). The rate and slope of the treadmill are gradually increased while the patient's vital signs and symptoms are monitored. This test provides information as to the presence or absence of a critical lack of blood flow to the heart muscle, the ability of the heart to safely meet the demands of increasing exercise without signs of heart failure. In addition, the heart rate and blood pressure at which abnormal symptoms occur can be determined. This information can then be used to develop safe exercise recommendations.

Historically, walking and stationary bicycling have been the preferred forms of exercise. In general, patients exercise at 65% to 85% of the maximum safe heart rate observed during the exercise treadmill test and at a frequency of two to four times a week for 30 to 45 minutes per session. The length and intensity of the exercise is increased as patients become more conditioned. Patients with more severe heart disease may wear a heart rate monitor as they exercise. As a result of careful assessment and monitoring, coronary events

in rehabilitation settings have become very low, less than 1 per 100,000 hours of patient exercise.

Exercise following a heart attack, surgery, or procedures has a number of benefits. Controlled trials of exercise after MI have demonstrated reductions in subsequent cardiac events and death from cardiovascular diseases. A study combining results from a number of studies found that participation in cardiac rehabilitation was associated with about a 25% reduction in overall mortality and mortality from cardiovascular causes over 3 years. However, most of the participants in these studies were men under age 65, and the studies were also done before many of the modern effective medical treatments were in widespread use. As most cardiac rehabilitation patients are 65 years or older and more women have begun to use these services, the results from earlier studies must be interpreted with caution. Regular exercise may also help provide favorable changes in how blood vessels function, may lower serum lipids, reduce blood clotting, and improve the balance between sympathetic and parasympathetic activities on the heart. Such small favorable changes across multiple systems may have benefit, whereas the individual changes by themselves are unimportant. Regular exercise also improves mood in depressed post-MI patients and may reduce anxiety and have other benefits. Finally, exercise testing and exercise may help evaluate patients' physical ability to return to work and resume sexual and other activities.

Cardiac rehabilitation programs usually include a medical director, an exercise physiologist, a nurse, dietician, and sometimes a mental health worker. Many programs are provided in hospital-based or community-based exercise facilities, but home-based programs have been shown to be equally effective. Some programs enroll patients for 6 months or less, while others provide ongoing services.

### Multifactorial Risk Reduction

Modern rehabilitation programs provide interventions to reduce a patient's risk of a subsequent cardiac event. The main lifestyle-related risk factors for a recurrent cardiac event are high levels of serum lipids, obesity, hypertension, diabetes, the use of tobacco, lack of regular physical activity, social isolation, and depression. Addressing two or more risk factors at a time is called multifactorial risk reduction.

High levels of blood lipids increase the risk of heart disease. Reduction in lipids reduces the rates of

subsequent heart attacks. Lipid lowering generally involves adoption of a low saturated fat, low cholesterol diet, weight loss, and the use of medications that alter the body's synthesis or absorption of various lipids. Although such combined interventions are effective in reducing lipid levels to very low levels, recent studies in clinical practice find that few patients meet the AHA or American College of Cardiology (ACC) target goals.

Weight loss also reduces cardiovascular risk, in part by reducing blood pressure and lipids. Exercise alone has little effect on weight loss, but when combined with dietary interventions may reduce the body mass index, a measure of how much a person weighs adjusted for height, by 4% to 9%. Cardiac rehabilitation programs usually have the personnel and programs to help participants adopt and maintain a low saturated fat, low cholesterol diet and reduce caloric intake.

Cardiac rehabilitation programs have also been very effective in helping patients with heart disease stop using tobacco. Many smokers will stop using tobacco following an acute MI. The most effective programs have included a strong recommendation by a physician to stop smoking, with interventions managed by a nurse during hospitalization and follow-up.

Other important risk factors include reducing blood pressure levels in the hypertensive individual, controlling blood glucose levels in individuals with diabetes, and the routine use of small doses of aspirin and drugs such as propranolol to protect the heart muscle during overexertion.

Risk factors are interactive and multiplicative. For instance, having both high blood cholesterol and smoking increases the risk of subsequent heart attacks more than if the two single risks were summed. Thus, multifactorial risk reduction programs are particularly important. A multifactorial risk-reduction program that combined intensive behavioral modification and medications resulted in a 30% reduction in saturated fat intake, a 4% reduction in BMI, a 22% reduction in LDL cholesterol (the "bad" cholesterol), 23% increase in HDL (the "good" cholesterol), and 20% improvement in exercise capacity. These improvements were associated with a decrease in the rate of atherosclerotic disease progress as well as in the rates of major clinical cardiac events and hospitalization.

Most cardiac rehabilitation interventions occur within the first 6 months of a heart attack, surgery, or

procedures. While the short-term effects are beneficial, a significant issue is the maintenance of risk-reduction changes that can be sustained for many years. Atherosclerosis is a progressive disease process requiring life-long attention to an active, healthy lifestyle.

### Psychosocial Aspects of Rehabilitation

Recovery from a heart attack, heart surgery, or other cardiovascular procedures involves a number of psychosocial aspects that are positively affected by rehabilitation. Patients who have had a life-threatening cardiac event find significant relief when they are able to exercise and resume their usual activities. Measures of anxiety, emotional stress, lack of self-confidence, depression, social isolation, and quality of life all improve after rehabilitation, although it is difficult to demonstrate that the changes are specific to cardiac rehabilitation.

Many studies have now shown that depression and social isolation after a coronary event are associated with increased morbidity and mortality rates. A recent large, multicenter study, involving nearly 2,500 men and women followed for up to 4 years following their heart attacks, found no differences in morbidity and mortality in depressed and/or socially isolated patients who were provided cognitive-behavioral therapy to improve mood and reduce social isolation compared to patients who received usual care. Depression improved significantly in both groups, resulting in small differences in measures of depression between treatment and control, which might have obscured potential benefits.

Most cardiac rehabilitation programs include stress management programs and programs designed to reduce anger and hostility. Although the effect of these programs on subsequent cardiovascular morbidity and mortality remains controversial, they are well received by patients.

One of the major benefits of cardiac rehabilitation programs has been in helping patients return to work and resume other customary activities. Twenty years ago, it was not uncommon for patients who had had a heart attack to stop working altogether or delay returning to work for many months. With modern medical therapies and exercise stress testing, most patients can safely return to work, resume sexual activity, and engage in customary leisure activities very soon after their return home from the hospital.

### Case Example

A 58-year-old man joined a cardiac rehabilitation program 3 weeks after discharge from the hospital following an acute MI. A lifelong smoker, he had been counseled to stop smoking while in the hospital and was able to do so upon discharge. On the initial evaluation in an outpatient cardiac rehabilitation program run by the YMCA, he was found to have elevated lipid levels, mild obesity, and was quite concerned that he might have a heart attack even with mild exercise. He also wanted to know when he could safely return to work. He underwent an exercise treadmill test that suggested he could safely exercise at a heart rate of 120 beats per minute. He was put on an exercise schedule that included group exercise as well as instructions to walk 30 minutes every other day at home. While not at exercise class, he was instructed to keep a diary of his exercise, including any symptoms he experienced during exercise. His doctor was contacted and he was started on a lipid-lowering medication. He was told that, based on the type of work he did and his treadmill results, he could return to work as soon as he wanted. He met with a dietician to receive recommendations for his diet and for weight loss, and with a nurse to review his medications and cardiovascular symptoms. Following the initial assessment and meeting with the physician, he participated in the group program for 3 months. After this period of time, the nurse maintained contact with him by phone once every other week for the next 3 months. During one of these phone calls, she noted that he missed a number of his medication doses and she recommended a simplified medication schedule. He continued to increase his exercise frequency and intensity until he was jogging 4 times a week for 30 to 40 minutes. He returned to work 6 weeks after his heart attack. After 4 months, his lipid levels had improved but not to the targeted levels. His physician was contacted and new medication was added. After 6 months, he was discharged from the program.

—C. Barr Taylor

*See also* HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HEART DISEASE AND DIET; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND REACTIVITY; HEART DISEASE AND SMOKING; HEART DISEASE AND TYPE A BEHAVIOR

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## CARDIOVASCULAR DISEASE PREVENTION: COMMUNITY-LEVEL INTERVENTIONS

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In the early 1970s, death rates from cardiovascular diseases (CVD) peaked in the United States; 499 of every 100,000 people died in 1973 from CVD, the leading cause of death for women and men across all racial/ethnic groups. The first major response to the CVD epidemic was initiated in the 1960s and was based on a medical model approach that focused on the identification and treatment of high-risk and moderate-risk patients. Federally funded research studies conducted during this era included the Veteran's Administration Cooperative Study, the Hypertension Detection and Follow-Up Program, the Lipid Research Clinic's Study, and the Multiple Risk Factor Intervention Trial. The medical model approach was unsuccessful in decreasing the number of new cases of CVD because most CVD actually occurs among the large number of individuals who are at relatively low risk. Although such individuals are at low relative risk, they contribute significantly to the population's attributable risk because of the widespread prevalence of CVD risk factors.

The second major response to the CVD epidemic, initiated in the late 1970s, was based on a primary prevention, or public health, model that sought to change the distribution of risk factors among individuals at the community level. This approach

was supported by evidence from clinical trials and prospective studies that clearly demonstrated that small changes in risk factors at the population level yielded greater reductions in rates of CVD than larger changes at the individual level. From 1978 to 1990, the following three comprehensive community-based CVD prevention trials were conducted with federal funding:

1. The Stanford Heart Disease Prevention Program (SHDPP), also known as the Five-City Project, included two intervention and two control cities in California (a third control city contributed only morbidity and mortality data) (Farquhar et al., 1985).
2. The Minnesota Heart Health Program (MHHP) included three intervention and three control cities in Minnesota and the Dakotas (Blackburn et al., 1984).
3. The Pawtucket Heart Health Program (PHHP) included one intervention city in Rhode Island and one control city in Massachusetts (Carleton, Lasater, Assaf, Lefebvre, & McKinlay, 1987).

Each of these trials simultaneously addressed the prevention and treatment of the known and modifiable risk factors for CVD; hypertension, cigarette smoking, high dietary fat, obesity, and sedentary lifestyle. Each intervention city received a comprehensive multifactor risk reduction education program that lasted from 5 to 8 years.

The risk reduction education programs used in these three trials were designed to facilitate the adoption of health practices, including direct education of health professionals and the public through media and personal contact as well as community organization to foster institutional and environmental support. Each trial integrated individual and social change approaches, employing some combination of social learning theory, social network diffusion theory, and social marketing to guide the intervention. Although the theoretical underpinnings were similar, the trials differed in their application of theory to the design of educational programs. SHDPP used television, radio, and print materials to target behavior change. MHHP emphasized face-to-face communications, public events, and television. PHHP focused on community organization, campaigns, screening counseling, and referral activities.

The results of each trial have been published (Carleton, Lasater, Assaf, Feldman, & McKinlay,

1995; Farquhar et al., 1990; Luepker et al., 1994). Each trial succeeded in developing and implementing its community-based intervention on a broad scale, involving large numbers of programs and participants. Furthermore, each trial reported strong favorable trends in a broad set of CVD risk factors among individuals in the intervention as well as control cities. However, in spite of the extensive programs implemented in the intervention cities, net improvement of risk factors in intervention over control cities was modest, generally of limited duration, and usually not statistically significant. The strongest treatment effects were documented by the SHDPP in the sample of individuals who were followed longitudinally, where the improvements in the intervention cities were significantly greater than those in the control cities for health knowledge, blood pressure, and smoking, but not for plasma cholesterol or obesity. No significant net improvement of risk factors in intervention over control cities was documented by the MHHP or PHHP. The investigators of the MHHP concluded that their program was unable to generate enough *additional* exposure in a sufficient proportion of the population to exceed the “remarkably favorable secular trends that were ongoing in the study communities” (Luepker et al., 1994).

In a follow-up analysis, the investigators pooled data from the repeated cross-sectional surveys conducted in all three trials (12 cities) to estimate the effect of the intervention with greater sample size than could be attained by a single study (Winkleby et al., 1997). In this larger data set, time trends were estimated for cigarette smoking, systolic and diastolic blood pressure, total cholesterol, body mass index, and estimated 10-year coronary heart disease mortality risk in women and men, 25 to 64 years of age. Results showed that the estimated effects in the intervention cities compared with the control cities were mostly in the expected and favorable direction: 9 out of 12 gender-specific comparisons favored the intervention cities. However, as shown in Table 1, most of the pooled effect estimates were modest in magnitude, and none reached statistical significance at the level of  $p < 0.05$ . The last two columns of the table show the net change and  $p$ -values for the primary hypothesis of an overall net intervention effect (intervention minus control). For example, smoking in the combined analysis declined by approximately 1% per year for both women and men in intervention and control cities. The decline was steeper in intervention cities

by an estimated 0.3% per year for both women and men, but the differences were not statistically significant ( $p$  values 0.48 and 0.54 respectively). For the majority of the remaining risk factors, the time trend was slightly but not significantly steeper in intervention cities than in control cities.

The results from these three CVD prevention trials have been the topic of much debate among health professionals, with many concluding that the large community-based intervention trials of the 1970s and 1980s “failed.” This interpretation is simplistic in that it does not consider the numerous methodological and analytic challenges that such studies face (Atienza & King, 2002; Winkleby, 1994). For example, Mittelman and coauthors (1993) provided a perspective on these studies and pointed out that the limitations of this type of community-based outcomes research include “a plethora of problems,” such as small numbers of analysis units, sampling difficulties, and most important, strong secular trends in control cities—all of which compromise the ability of even the best-endowed studies to detect statistically significant intervention effects. Contributing to the secular trends during the 1970s and 1980s was the acceleration of health promotion via the popular press; the increased health promotion activities by voluntary health agencies such as the American Heart Association and the American Cancer Society; and the advent of broad-based federal programs, such as the National High Blood Pressure Education Program, the National Cholesterol Education Program, and the American Cancer Society’s Great American Smokeout.

One explanation for the poorer-than-expected outcomes of the community trials is that although these interventions were applied on a communitywide basis, they did not focus on populationwide prevention strategies that address social factors that influence the distribution of risk factors (Link & Phelan, 1995). Rather, their main focus was on providing health resources to a large number of individuals in communities where the responsibility for maintaining and improving health was with the individual. The rationale for this approach is that once individuals are informed of their risk, they will adopt or modify behaviors to lower that risk. The emphasis is on providing individuals with information, knowledge, or skills so they can avoid or modify high-risk behaviors. While an individual approach can be effective for addressing health problems (especially at the secondary

**Table 1** Cardiovascular Risk Factor Trends in Women and Men aged 25 to 64, Joint Analysis of Three U.S. Community-Based Intervention Trials for Cardiovascular Risk Reduction, 1978-1990, Combined Trends, Adjusted for Age and Education<sup>a</sup>

Risk factor	Linear time trend (per year) <sup>b</sup>			Tests of net intervention effect <sup>c</sup>
	Intervention	Control	Net change (intervention minus control)	
Current cigarette smoking, %				
Women	-1.09 ± 0.30	-0.79 ± 0.30	-0.30 ± 0.42	p = 0.48
Men	-1.31 ± 0.36	-1.00 ± 0.36	-0.31 ± 0.51	p = 0.54
Systolic blood pressure, mmHg				
Women	-0.57 ± 0.16	-0.27 ± 0.16	-0.31 ± 0.22	p = 0.17
Men	-0.63 ± 0.17	-0.53 ± 0.17	-0.10 ± 0.24	p = 0.68
Diastolic blood pressure, mmHg				
Women	-0.15 ± 0.11	+0.08 ± 0.11	-0.23 ± 0.16	p = 0.15
Men	-0.25 ± 0.16	-0.15 ± 0.16	-0.09 ± 0.23	p = 0.68
Total cholesterol, mg/dl				
Women	-0.38 ± 0.34	-1.08 ± 0.34	+0.70 ± 0.48	p = 0.15
Men	-0.56 ± 0.36	-0.79 ± 0.36	+0.23 ± 0.51	p = 0.66
Body mass index, kg/m <sup>2</sup>				
Women	+0.10 ± 0.03	+0.16 ± 0.03	-0.06 ± 0.05	p = 0.19
Men	+0.11 ± 0.03	+0.08 ± 0.03	+0.03 ± 0.04	p = 0.46
Log <sub>10</sub> estimated 10-year coronary heart disease mortality risk				
Women	-0.011 ± 0.002	-0.010 ± 0.002	-0.001 ± 0.003	p = 0.85
Men	-0.009 ± 0.002	-0.008 ± 0.002	-0.001 ± 0.002	p = 0.64

<sup>a</sup> Adapted from Winkleby, Feldman, & Murray (1997).

<sup>b</sup> Estimate ± standard error, from mixed-model analysis of variance with pooled error term.

<sup>c</sup> Test for presence of net intervention effect (i.e., difference between combined intervention and control trends).

and tertiary prevention levels), it often has had limited success because it (a) places the burden for change on individuals who are often those with the fewest resources, (b) deflects attention away from important factors in the social and physical environment that influence choices regarding health-related behaviors, and (c) does not provide reinforcement of positive health behaviors from the environment in which an individual lives and works.

In addition to the strong secular trends in control cities, there are other issues that complicate the interpretation of the three CVD prevention trials. Some of these issues relate to the composition of the communities themselves. For example, just as some individuals have better resources for changing health behavior,

it is plausible that some neighborhoods within the intervention cities had better resources to support positive behavior change than other neighborhoods, resulting in greater change among the individuals living within the higher resource neighborhoods. This differential change would be masked by overall results that combined all neighborhoods within an intervention city. The possibility of this effect is supported by previous studies that have shown that the onset of the decline in CVD occurred earlier in areas with greater resources (Wing, Barnett, Casper, & Tyroler, 1992).

What, then, is the future of community-based CVD prevention efforts? The rationale for the community approach to CVD control is evident; it includes a high

degree of generalizability, cost effectiveness in using mass communication methods, diffusion of information through increased discussion about health, and ability to influence environmental, regulatory, and institutional policies that enhance health. Also evident is the need for programs and strategies that encourage people to stop smoking, undergo blood pressure screening and treatment, exercise regularly, decrease overconsumption of food, and increase consumption of vegetables and fruits. Recent CVD prevention and control programs are combining individual with populationwide strategies that involve collaborative community involvement and infrastructure development that address environmental and policy change (Israel et al., 1998). This combination of strategies appears promising. For example, the Child and Adolescent Trial for Cardiovascular Health (CATCH) demonstrated that changes in policies and practices of schools can positively affect health behaviors. CATCH included 56 intervention and 40 control schools and used a 3-year intervention that modified the fat content of school lunches and increased the intensity of activity in physical education classes. Intervention schools showed significantly greater reductions in energy intake from fat and greater increases in intensity of physical activity compared with control schools following the intervention (Luepker et al., 1996).

The most recent studies are broadening the concept of the population approach to prevention by examining how the social and physical milieu of communities may affect individual health behaviors and CVD (Diez Roux et al., 2001). These studies are also broadening the concept of evaluation to include not only physiological endpoints but also qualitative parameters at the individual, organizational, and policy levels that may influence health. The underlying premise of these studies is that an individual's ability to adopt and maintain healthy behaviors is influenced by goods and services in his or her community as well as policies and regulations at both the local and national levels. This premise is supported by the theoretical literature that proposes that personal, cultural, and environmental factors interact to determine an individual's health behaviors. This new, broader approach to the prevention of CVD will allow investigators to examine underlying determinants of CVD, with the hope that all people, including those in population subgroups that bear a disproportionate burden of cardiovascular morbidity and mortality, will have the

opportunity and resources for enhanced cardiovascular health.

—Marilyn A. Winkleby

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See also HEALTH PROMOTION AND DISEASE PREVENTION; HEART DISEASE AND DIET; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND SMOKING; NEIGHBORHOOD EFFECTS ON HEALTH AND BEHAVIOR

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## CARDIOVASCULAR PSYCHOPHYSIOLOGY: MEASURES

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The existence of physiological concomitants of emotional stress has long been recognized, but only relatively recently have they been the subject of systematic scientific inquiry. Historically, Walter B. Cannon's 1915 landmark text, *Bodily Changes in Pain, Hunger, Fear and Rage*, set the stage for the field of cardiovascular psychophysiology, which has emerged with the objective of documenting cardiovascular correlates of behavior, with particular emphasis on the effects of stress. A guiding research hypothesis has been that psychological stress may contribute to the development of cardiovascular disease and also to the occurrence of acute clinical events such as heart attack in patients rendered susceptible by preexisting disease. Therefore, considerable effort has been devoted to characterizing responses of the cardiovascular system elicited by stress in order to illuminate the physiological mechanisms whereby stress may be implicated in cardiovascular pathophysiology.

### LABORATORY STUDIES

For the past 50 years, research on the effects of stress on blood pressure (BP) has been dominated by "cardiovascular reactivity" studies, in which a variety of cardiovascular measures are recorded while human volunteers are subjected to psychologically stressful tasks in a research laboratory setting. Responses to a wide variety of stressors have been documented, including reaction time tasks, mental arithmetic, simulated public speaking, cold pressor tasks, and a variety of psychomotor tasks. One important feature of cardiovascular responses to these laboratory-based stressors is that individual differences are strikingly varied. For example, while some individuals may show an increase in heart rate (HR) of 50 beats per



minute (bpm) during a mental arithmetic task, others may exhibit only 1 or 2 bpm change in HR. Moreover, individual differences in cardiovascular reactivity appear to be relatively stable traits, exhibiting consistency across stressors and stability over time. Here we briefly describe a number of physiological measures commonly used in cardiovascular psychophysiology research.

### Heart Rate

Heart rate, expressed in bpm, is perhaps the most widely used measure in cardiovascular psychophysiology. HR is usually quantified from the electrocardiogram (EKG), based on the time-interval between successive R-waves in the EKG complex. The EKG R-R interval, or interbeat-interval (IBI), measured in milliseconds, is favored by many physiologists because it is considered to be the critical parameter regulated by the autonomic nervous system. HR is more familiar because it is readily accessible by counting the pulse, and shows a reciprocal relationship with IBI, as shown by the formula  $HR \text{ (bpm)} = (60)/(IBI \times 1000)$ .

### Blood Pressure

The most commonly measured characteristics of arterial BP are the maximum and minimum pressures with each heartbeat, referred to as systolic blood pressure (SBP) and diastolic blood pressure (DBP) respectively. The emphasis on these parameters, both in medicine and in psychophysiology research, is partly a reflection of their relative ease of measurement using noninvasive techniques. SBP and DBP are most commonly assessed in the arm's brachial artery, using either the auscultatory or oscillometric measurement technique. Both techniques employ an occlusion cuff that is inflated to first interrupt and then progressively restore blood flow through the brachial artery. With the auscultatory method, a microphone or stethoscope is then used to detect Korotkoff sounds (caused by turbulent blood flow in the brachial artery) as the cuff slowly deflates. SBP is recorded as the cuff pressure in mm Hg corresponding to the first detection (Phase I) of Korotkoff sounds, and DBP is the pressure corresponding to the muffling (Phase IV) or disappearance (Phase V) of Korotkoff sounds. Mean arterial pressure (MAP) is then estimated using the formula  $MAP = DBP + (SBP - DBP)/3$ . With oscillometric BP

measurement, pulsatile pressure oscillations that are transmitted from the brachial artery to the occlusion cuff provide the basis for BP assessment. When the cuff slowly deflates through SBP, pulsatile pressure oscillations that arise in the cuff mark SBP; subsequently, the maximum amplitude of cuff pressure oscillations indicate MAP; when cuff pressure oscillations become markedly attenuated, DBP is indicated. SBP and DBP are measured in millimeters of mercury (mm Hg).

In addition to these traditional methods, there are newer techniques for assessing BP on a beat-by-beat basis that have become widely used in cardiovascular psychophysiology. The most accurate and direct is intraarterial recording of the arterial pulse pressure waveform, which is invasive and not without risk. However, there are noninvasive beat-by-beat assessment techniques that have become widely accessible with the commercial packaging of the advanced technology on which they depend. Arterial tonometry is a technique that involves the application of a pressure transducer to skin that is directly over an artery (e.g., the radial artery in the wrist). A small amount of pressure is applied to the transducer, and pressure changes in the artery are transmitted through the tissues to the skin, where they are measured precisely. The arterial BP waveform is calibrated against values from a BP cuff at another site (e.g., brachial artery at heart level). There is also the "vascular unloading" technique that involves inflating a small BP cuff positioned around a finger. With this technique, blood volume in the artery under the cuff is detected with a photoplethysmographic sensor (i.e., light sensor), and this information is used to keep volume constant by almost instantaneous adjustments in cuff pressure; with this approach, cuff pressure mirrors arterial pressure in the finger. Assessment of beat-to-beat BP is of considerable interest because it makes possible an assessment of rapid changes in BP, whereas the more traditional upper arm occlusion techniques are limited to BP measurements of about once per minute. It is important to note, however, that BP does not remain constant throughout the arterial system, with pulse pressure widening as arteries become more peripheral. Thus, SBP is typically higher in the finger than the arm, and DBP typically lower. Moreover, BP responses to stress are often greater in the finger than the arm, emphasizing the importance of ascertaining the BP measurement technique employed when comparing findings from psychophysiological studies.

### Cardiac Output and Systemic Vascular Resistance

When cardiac output (CO), the volume of blood pumped by the heart per minute, is measured simultaneously with BP, it is possible to gain a more complete hemodynamic assessment of circulatory responses by also deriving total peripheral resistance (TPR) of the vascular system. TPR is computed by dividing MAP by CO; as implied by this equation, changes in BP are the direct result of changes in either CO and/or TPR. Thus, a BP increase during stress may, for example, be characteristic of the fight-or-flight response (increased CO and decreased TPR), or a net peripheral vasoconstriction response (increased TPR), or a simultaneous increase in both CO and systemic vascular resistance (SVR). Cardiovascular psychophysiology research over the last 20 years has established that there are marked individual differences in hemodynamic response patterns during stress; that such individual differences appear to be relatively stable psychophysiological traits; and that these response patterns may be related to cardiovascular disease risk.

Most behavioral research studies that have included CO assessment have used impedance cardiography, a noninvasive, unobtrusive and continuous measurement technique that is ideally suited for monitoring cardiovascular responses during psychological stress. Impedance cardiography involves the application of four disposable band-electrodes around the neck and chest, together with a standard EKG. Because the impedance cardiogram is susceptible to respiratory and movement artifact, computer ensemble averaging is typically employed to enhance measurement reliability.

### Limb Blood Flow

The measurement of forearm blood flow is one of the longest established cardiovascular psychophysiology measurements. Blood flow to the forearm is of interest because it is considered to provide an indication of blood flow responses to the skeletal muscles, which should increase during stress if the fight-or-flight response is elicited. Venous occlusion plethysmography is the technique most widely used to assess forearm blood flow. This technique involves placement of a two occlusion cuffs around the arm, one just above the crease of the elbow, and one around the wrist. The upper arm cuff is inflated to a pressure above venous BP but below DBP (e.g., 40 mm Hg) for

a few seconds, and then deflated for several seconds; during inflation, blood flows freely into the forearm but cannot escape. The wrist cuff is inflated to a suprasystolic pressure (e.g., 200 mm Hg) to obviate measurement of blood flow into the hand. A volumetric transducer, typically a mercury-in-Silastic strain gauge, is used to quantify the rate of increase in forearm volume, which is attributed to the inflow of blood in milliliters per minute (ml/min).

### Autonomic Nervous System

Cardiovascular responses to stress often involve both branches of the autonomic nervous system, and there are a variety of measures of autonomic activity that are more or less specific to the sympathetic (SNS) and parasympathetic (PSNS) nervous systems. For example, HR is regulated by both the SNS and PSNS, increasing with heightened sympathetic outflow to the heart and decreasing with heightened parasympathetic activity.

Commonly used indices of SNS activity include measures of cardiac contractility and catecholamine levels in the blood and/or urine. Preejection period (PEP) is a systolic time interval, referring to the portion of the cardiac cycle during which the left ventricle contracts isovolumetrically, prior to the ejection of blood into the aorta. PEP shortens with increased SNS influences on the heart and is therefore inversely related to SNS activity. However, PEP is an imprecise measure of SNS activity because it is affected by other factors, most notably cardiac preload and afterload. The Heather Index is a related index of cardiac contractility that is unique to impedance cardiography. It is derived by dividing peak left ventricular ejection velocity by the time required for its achievement during cardiac systole. Both PEP and the Heather Index may be measured noninvasively.

Catecholamine levels in the blood show robust responses to stress. Plasma norepinephrine (NE) and epinephrine (EPI) are the two most commonly measured catecholamines. NE is the postsynaptic neurotransmitter used by the SNS, whereas EPI is released by the SNS into the circulation from the adrenal medulla and thereby acts like a hormone by reaching target receptors in the heart and vasculature through the circulation. The half-life of catecholamines in the blood is very brief, and therefore timing of blood sampling intended for catecholamine analysis is a critical consideration. Ideally, blood should be sampled using

a continuous withdrawal pump, and immediately stored on ice, in order to provide plasma catecholamine samples that will be most representative of responses to acute laboratory challenges. Using either high-performance liquid chromatography (HPLC) or radioimmunoassay (RIA), both NE and EPI can be assayed from arterial or venous blood samples, as well as from urine samples.

NE and EPI exert their effects on the circulation via adrenergic receptors in the heart and vasculature. To better understand how the SNS mediates the cardiovascular effects of stress, psychophysiological research has also included the evaluation of cardiovascular alpha- and beta-adrenergic receptors. Available techniques include the *in vivo* response of the heart and vessels to the intravenous infusion of selective adrenergic receptor agonists (e.g., isoproterenol and phenylephrine), and *in vitro* techniques that quantify the density and sensitivity of adrenergic receptors on tissue samples (e.g., blood lymphocytes and platelets).

Two widely used measures of parasympathetic nervous system activity are high frequency heart rate variability (HF-HRV) and baroreceptor sensitivity (BRS). HF-HRV is commonly termed respiratory sinus arrhythmia (RSA) because HF occurs at respiratory frequencies (i.e., 0.15-0.40 Hz), with HR typically increasing during inspiration and slowing with expiration. Multiple mechanisms contribute to HF-HRV, and therefore it does not reliably measure the absolute level of vagal input to the heart in every measurement context, and HF-HRV is best used to assess changes in parasympathetic cardiac control. In addition, HF-HRV values are related to the rate and volume of respiration, so accounting for respiration is important for optimal interpretation of HF-HRV. Several techniques have been employed to quantify HF-HRV, but all essentially involve accurate measurement of the cardiac interbeat interval (IBI) in milliseconds, so that the variations occurring in the respiratory frequency can be quantified and expressed in  $\text{ms}^2/\text{hz}$  or  $\ln(\text{ms}^2)$ .

Baroreceptor sensitivity (BRS) is a measure of the functioning of a reflex loop involving pressure-sensing nerves (i.e., baroreceptors) in the carotid arteries and the aorta. Changes in arterial pressure stimulate the baroreceptors, and HR is increased or reduced via the vagus nerve as a buffering mechanism to maintain appropriate BP. The arterial baroreceptors also maintain a tonic level of vagal activity in the absence of

rapid arterial pressure changes, so the contribution of arterial baroreflexes to parasympathetic tone is substantial, although other mechanisms such as central vagal drive are also involved. There are several methods for measuring BRS. Invasive methods involve the use of vasoactive drugs to induce changes in arterial BPs or mechanical suction applied to the neck to activate or deactivate the carotid artery baroreceptors. Changes in heart period resulting from changes in arterial pressures are then used to assess BRS. Noninvasive methods of measuring BRS involve the analysis of continuously recorded SBP and IBI to reveal spontaneous BRS, typically expressed in  $\text{ms}/\text{mmHg}$ .

## ULTRASOUND IMAGING

The use of ultrasound imaging techniques has gained popularity in cardiovascular psychophysiology as an approach to evaluating both causes and consequences of cardiovascular responses to stress. Echocardiography is perhaps the most widely used approach to assessing “target organ damage” in terms of cardiac structure and functional pathology such as left ventricular hypertrophy (LVH), or enlargement of the heart. Vascular imaging techniques also have been used to evaluate vascular damage, as indexed by the presence of arterial (e.g., carotid) plaques and measures of arterial intima-media thickness (IMT). Vascular ultrasound measurement of flow-mediated dilation (FMD) of the brachial artery also has been employed to assess vascular endothelial function. Recent FMD studies in cardiovascular psychophysiology suggest that endothelial function may both alter and be altered by the stress response.

## AMBULATORY MONITORING STUDIES

### Ambulatory Blood Pressure Monitoring

Technological advances in BP monitoring equipment have made the assessment of ambulatory blood pressure (ABP) widely available. ABP monitors are wearable and relatively unobtrusive devices, typically using auscultatory or oscillometric methods to noninvasively measure ABP during typical daily activities and during nighttime sleep. Assessment of ABP often takes the form of a 24-hour ABP record with defined measurement intervals (e.g., every 15 minutes during the day and every 30 minutes during nighttime sleep). During waking hours, psychophysiological ABP

assessments usually also require subjects to complete a small paper or electronic diary following each waking ABP measurement. The diary is used to collect information about the time of the ABP reading and recent ingestion of substances that may affect BP (e.g., tobacco, caffeine), as well as the person's posture, physical activity, location, and mood or psychological state (e.g., perceived stress level). ABP studies have demonstrated that real-life stress is associated with higher ABP in association with chronic real-life stress (e.g., job strain), and also that the occurrence of more brief episodes of stress is associated with acute rises in ABP. Diurnal ABP patterns are also of interest, with recent evidence that "nondipping," or failure to exhibit the typical drop in BP during the nighttime sleep period, is associated with heightened cardiovascular risk and target organ damage.

### Ambulatory Hemodynamics

Several ambulatory impedance cardiography monitors have become available to researchers in the last few years. These monitors are similar in size to ABP monitors and provide a means of 24-hour monitoring of cardiac performance, including cardiac output. When worn and configured to take measurements simultaneously with ABP monitors, they provide a combined capability of 24-hour hemodynamic monitoring.

### Heart Rate Variability

Measures of HRV derived from 24-hour EKG recordings have been used for many years to assess autonomic functioning. Interest in ambulatory assessment of HRV derives in part from the fact that 24-hour HRV is an independent predictor of risk of mortality following MI and because depressed cardiac patients have been observed to have lower HRV than non-depressed patients. A number of time domain and frequency domain methods can be used to quantify the variation in HR or R-R interval. For example, a very widely used time domain measure is the standard deviation of all normal R-R intervals (SDNN). When frequency domain measures are used, the high frequency component (HF-HRV) is often interpreted to reflect parasympathetic cardiac control. However, the same interpretative caveats discussed for laboratory measures of HF-HRV apply to longer collection periods (e.g., the need to control for the influences of respiration). In fact, the autonomic origins of various

measures derived from 24-hour HRV measures can be difficult to interpret because of the contribution of nonautonomic factors to variation in HR (e.g., hormones, activity, posture).

### Catecholamines

A few studies have assessed SNS activity according to plasma catecholamine levels in an ambulatory setting by using wearable blood withdrawal and collection systems. However, more commonly, the collection and cold storage of urine by study participants has been used to provide an index of overall SNS activity over periods from hours to days. Urinary NE and EPI excretion rates should be adjusted for individual differences in body size, for example, by expressing excretion rates relative to creatinine excretion (a byproduct of muscle metabolism). In contrast to plasma catecholamines, NE may be a more meaningful SNS index as measured by urinary excretion, whereas urinary EPI levels may be confounded by EPI originating in the kidneys (especially in patients with hypertension).

### SUMMARY AND FUTURE DIRECTIONS

This entry has summarized some of the measurement techniques employed in the field of cardiovascular psychophysiology. Using these techniques, the cardiovascular response to psychologically demanding tasks has been documented comprehensively in the laboratory setting, and there is compelling evidence to suggest that the stress response may be a cardiovascular risk factor for some individuals. In recent years, cardiovascular psychophysiology research in the "real world" has been made possible by the development and refinement of ambulatory measurement techniques. Ambulatory cardiovascular psychophysiology appears likely to play a more prominent role in the future, where it promises both to confirm and extend our understanding of cardiovascular-behavioral interactions and the relationship of stress to cardiovascular risk.

—Andrew Sherwood and Joel W. Hughes

*See also* ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS; BLOOD PRESSURE AND HYPERTENSION: MEASUREMENT; BLOOD PRESSURE AND HYPERTENSION: PHYSICAL ACTIVITY; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CARDIOVASCULAR PSYCHOPHYSIOLOGY: MEASURES; CARDIOVASCULAR REACTIVITY; HOSTILITY: PSYCHOPHYSIOLOGY; PSYCHOPHYSIOLOGY: THEORY AND METHODS

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## CARDIOVASCULAR REACTIVITY

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Cardiovascular reactivity (CVR) has been defined by Stephen B. Manuck, a seminal theorist in this area, as “an individual’s propensity to experience cardiovascular reactions of greater or lesser magnitude, in relation to those of other persons, when encountering behavioral stimuli experienced as engaging, challenging, or aversive” (Manuck, 1994).

Several studies indicate that behavioral and psychosocial factors such as anger, hostility, Type A personality, lack of social support, and exposure to stress are linked to hypertension (HTN) and/or coronary heart disease (CHD). The pathways by which these factors promote disease remain controversial. A predominant psychophysiological theory invokes a model in which CVR acts as the primary marker or pathway. The reactivity hypothesis originally stated that persons classified as “hyperreactors” (those exhibiting large cardiovascular responses) to stressful stimuli may be at increased risk of developing HTN (the “weak” form of the hypothesis). In its stronger form, the hypothesis states that such hyperreactivity plays a causal role in the sustained elevation of resting blood pressure (BP)

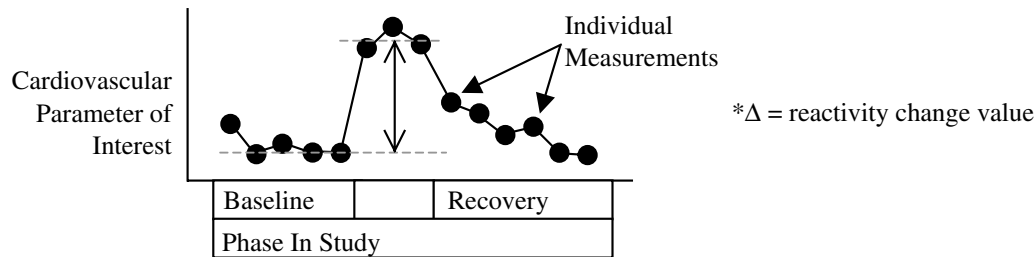
and development of HTN. More recently, reactivity has been postulated to also play a role in the development of CHD.

## STRESS

The physiologist W. B. Cannon first used the term *stress* in a nonengineering context to refer to the influences of the environment on psychological processes that in turn were related to physiological outcomes (see Stress, Appraisal, and Coping in this volume). The idea was further developed by R. S. Lazarus and his colleagues, who suggested that a person must perceive a situation as “stressful” before a physiological stress response will occur. This notion holds important implications for current research in stress. Rick Turner, in his excellent book on CVR and stress (Turner, 1994), points out that the purpose of fight-or-flight responses, as Cannon described them, is to prepare the organism for immediate physical action. Increased cardiovascular activation, as well as neurohormonal activity such as the release of cortisol, act to facilitate the additional nutritional supply needed for such physical activity and the preparation to minimize damage due to physical threat. Turner notes that in a highly evolved social society, the threats may be symbolic, such as may occur in an unpleasant social interaction, rather than physical; however, it appears that these challenges may evoke physiological adjustments that are similar to those seen in response to a physical threat. There are two important implications to this, Turner suggests: (1) moderate levels of cardiovascular and neurohormonal arousal may be repeatedly elicited during everyday life, and (2) these responses may be modeled in the laboratory using psychological challenges.

## ORIGINS OF THE CARDIOVASCULAR REACTIVITY MODEL

In the 1930s, E. A. Hines and G. E. Brown sought a means by which physicians might identify persons at future risk for high BP (Hines & Brown, 1936). The rationale was clearly stated by Ayman and Goldshine (1938): “[M]any young people are certain to develop essential HTN some day. If it were possible to apply a standard stimulus to such persons, it might be possible to determine a group in which an abnormally great reaction resulted from this stimulus. In other words, it might be possible to determine in advance the future subjects of essential HTN.”



**Figure 1** Schematic Representation of a Cardiovascular Reactivity Study

To this end, Hines and Brown conducted a study that was to become a model for CVR testing: normotensives and hypertensives first sat quietly while BP measurements were taken to provide a resting, or baseline level, and then were exposed to a cold stimulus (the “cold pressor test”), in which the hand was immersed in ice water. The measure of reactivity was the difference in BP between the prestress baseline and stressor levels. They found that, compared to normotensives, hypertensive patients exhibited greater BP reactivity in response to the cold stimulus; in addition, they found that the BP of the normotensives tended to return to the prestress level more quickly. These results have been replicated in several subsequent studies.

### The Study of Cardiovascular Reactivity in the Laboratory

Certain features are common to most CVR studies, and have remained remarkably consistent across studies and over time. Figure 1 shows a schematic of a typical reactivity study.

1. Subjects are instrumented with a device that measures cardiovascular variables (usually BP and/or heart rate).
2. Subjects sit quietly during a baseline period (a), usually between 5 and 30 minutes. The purpose of this phase is to provide a within-person comparison against which the effect of the stressor may be assessed.
3. A stressor is then presented (b). The duration is usually 2 to 5 minutes, although longer tasks have been used. The mean of the cardiovascular measurements is generally computed, although peak response is sometimes used.
4. A change score is usually computed, in which the baseline measure is subtracted from the stressor level ( $\Delta$ ). Some researchers statistically control for the effect of the baseline level, to account for individual differences in resting levels.

5. In some studies, recovery from stress is assessed during a posttask rest period (c).

### A Trait Conceptualization of Cardiovascular Reactivity

Following Hines and Brown, for almost two decades reactivity studies used the cold pressor as the stressful stimulus. An important assumption implicit in these studies was that the particular eliciting stimulus didn't matter, as long as the *same* stimulus was used across subjects. This underscores the view, held early on, that CVR was a generalized trait, that is, some people are simply more reactive than others, regardless of the stimulus, and these persons are at greater risk for developing HTN.

### Cardiovascular Responses to Mental or Emotional Stressors

The first use of a “mental” task, a stressful interview, occurred in the 1950s. Later, mental arithmetic was used and soon became (and remains) the most commonly used mental stressor in reactivity testing, although many other tasks, such as the Stroop color-word matching task, public speaking, and star-mirror tracing, have been used.

If indeed the choice of the stimulus is arbitrary, then cardiovascular responses to one stressor should predict those to any number of others. In the 1970s, studies evaluating this premise were performed, and it became clear that a great deal of inconsistency between responses to different stressors existed, with intertask correlations in the range of 0.40 to 0.50. This led to important advances in the conceptualization of the reactivity model in that researchers became concerned with the meaning and selection of the eliciting stimulus.

### Stability of Cardiovascular Reactivity Within Persons Over Time

A crucial aspect of any trait concerns its stability over time, usually assessed as “test-retest reliability.” Manuck (1994) reported that test-retest coefficients for systolic and blood pressure change averaged only 0.51 and 0.34, respectively. In recent studies, Thomas Kamarck and his colleagues found that, as might be expected from classical measurement theory, aggregating measurements to several stimuli improved the test-retest reliability (Kamarck, Jennings, Debski, Glickman-Weiss, & Johnson, 1992). These results suggest that the CVR *construct* is fairly stable over time, but that the observed reliabilities have been limited by the single-stimulus methodology commonly employed.

### Do Cardiovascular Stress Responses Generalize to the Natural Environment?

In a *risk marker* model, reactivity observed in the laboratory is thought to be associated with the development of disease, but is not necessarily thought to play a causal role. However, in a model in which reactivity is considered to be a *cause* of disease (i.e., the “strong” version of the reactivity hypothesis), responses measured in the laboratory will allow prediction of disease development only to the extent that laboratory reactivity is a good analogue of cardiovascular adjustments that occur in the natural environment. Thus, several studies have examined the laboratory-to-life generalizability of laboratory-based CVR measurements. For the most part, these studies have yielded weak results. Several studies show a failure of laboratory reactivity to generalize to real-world situations. Others indicate small to moderate generalizability of some measures or some reactivity tasks.

Reactivity is exquisitely vulnerable to situational effects. Thus, there may be no “true” reactivity that can be captured in the laboratory. Situational effects and person-by-situation interactions place limits on the potential for generalizability, as laboratory-life comparisons are inherently cross-situational. However, even studies in which exposures are uniform show that laboratory reactivity poorly predicts cardiovascular responses in the natural environment. A distinction must be drawn, however, between the cardiovascular reactivity *construct* and the laboratory *method*; thus, it remains entirely possible that frequent BP and/or heart rate elevations in response to stress are a factor in the

development of HTN and/or CHD, and that our failure to observe laboratory-to-life generalizability represents only a limitation of laboratory measurements.

### Prospective Studies of Cardiovascular Reactivity and the Prediction of Hypertension

A handful of prospective studies have been conducted in which reactivity testing has been performed in normotensives who were then followed to determine which subjects became hypertensive and which did not (it was later that outcome measures other than HTN became a focus of the reactivity model).

Four of the earlier studies (all using the cold pressor) did not find that reactivity predicted the future development of hypertension. One study claimed positive results, but of the 207 subjects followed over a period of 27 years, only 4 subjects became hypertensive, 3 of whom had a positive family history of hypertension. More recently, two studies have shown positive results. In one, normotensives who exhibited greater blood pressure reactivity to the cold pressor tended to be at greater risk for developing HTN during a follow-up period of 45 years. A second study showed similar results, with the effect appearing more pronounced in men under age 45 and after controlling for other traditional risk factors. However, a recent study of British civil service employees (the Whitehall Study) failed to find evidence of a prospective association.

Several prospective studies have examined cardiovascular responses of children and adolescents. In a recent comprehensive review, Frank Treiber and his colleagues (Treiber et al., 2002, in press) provide details of several studies that have used a variety of laboratory stressors to predict subsequent BP levels. Treiber notes that the 10 studies reviewed all showed positive results, with children who exhibited larger acute BP responses to mental stress having higher subsequent resting BP levels. Treiber et al. concluded that CVR is a consistent independent predictor of future hypertensive status when long-term follow-ups are conducted.

### Prospective Studies of CVR and the Prediction of Subclinical and Clinical Endpoints

Treiber et al.'s (2003) recent paper provides an excellent review of the prospective studies of subclinical and clinical endpoints; a summary is presented below.

*Prediction of left ventricular mass (LVM).* Only one study to date has examined LVM in adults, which is the strongest predictor of CVD morbidity and mortality other than advancing age; the results showed that CVR to mental arithmetic and an isometric handgrip task accounted for 15% of the variance in LVM change over a 3-year period. A few studies have been conducted in which children were studied, and although some positive results have been found, these were often confounded with other predictors, such as body mass index and height.

*Prediction of carotid atherosclerosis.* At this time, there have been four longitudinal studies of the prediction of carotid atherosclerosis. Treiber et al. report that these studies have tended to be positive, although the pattern of results has been varied and straightforward interpretations of the causal nature of the relationships problematic. In one particularly interesting study, Susan Everson and her colleagues found a significant interaction between systolic BP reactivity and job demands on several measures of carotid atherosclerotic progression, with the high work demands-high reactor group showing the greatest degree of 4-year progression. The pattern of effects was observed even among those men without prevalent ischemic heart disease; however, the strongest effects were observed among the portion of the sample with some evidence of carotid thickening at baseline.

*Prediction of clinical CVD or its progression.* The most significant results would concern the prediction of actual clinical events. In their review, Treiber et al. showed that the results of the six studies that have been published to date again are mixed. Two of the studies showed no relationship, three did show a relationship (although in one the relationship was only with diastolic reactivity, not systolic or heart rate). Moreover, in one of the studies showing a positive outcome, the measure of reactivity used was the difference between BPs taken by a doctor and by a nurse. This "white coat effect," however, may represent a qualitatively different dimension than other mental stressors. In the sixth study, an *inverse* relationship was found, with *lower* heart rate reactivity predicting mortality. The inconsistency among the results highlights the type of problems that continue to plague the reactivity literature. There is little standardization of stressful laboratory tasks, the assessment methods and venues differ and may affect acute cardiovascular responses, and it remains unclear what any particular stressful stimulus may represent for a particular person.

In summary, while there is some evidence that cardiovascular reactivity may predict the development of HTN, of preclinical disease states, and of clinical events and mortality, the data remain sparse and inconsistent, and strong conclusions remain unwarranted.

### The Influence of Paul A. Obrist

Many stressors have been used in CVR studies, but little standardization has occurred and often there is no particular rationale for the use of one stressor or another. However, in the 1970s, Paul A. Obrist, a prominent psychophysiological, made an important contribution in this area.

Obrist suggested that many behavioral stressors involve "active coping," that is, exercising control and effort to cope with stress. In contrast, a passive stressor was one that did not elicit such coping efforts. He hypothesized that situations that provoked active coping produced in some persons reactions of the heart that are unjustified in terms of concurrent levels of metabolic activity. Thus, sizable increases in cardiac activity occur, but in the context of only marginal increases in energy expenditure. Douglas Carroll (Carroll, 1992) has pointed out that this pattern of reaction contrasts to responses to physical exercise, where the amount of the increase in cardiac activity closely mirrors the increase in the physical demands of the exercise. Obrist has suggested that this results in overperfusion, particularly of skeletal muscle tissue. Blood is pumped to these muscles to an extent that is surplus to the muscles' requirements for energy. This in turn precipitates vascular autoregulation, adjustments to the circulation in order to compensate for the overperfusion. These autoregulatory adjustments take the form of increases in arterial resistance.

This sequence of events, it is argued, leads to a sustained increase in BP occurring in response to even transient stressors. BP rises initially as a result of increased cardiac activity; the BP elevation is then maintained by the autoregulatory increase in resistance.

Obrist's research marked a turning point in reactivity models, in part because it suggested that psychological dimensions of the stressor stimulus were important, and provided a distinction between active coping and passive stressors.

Indeed, active and passive coping appear to differ in their hemodynamic effects. Active coping appears to elevate blood pressure via increases in stroke volume and cardiac output. Passive stressors, in contrast, appear to elevate blood pressure by increasing total peripheral resistance. However, neither active nor



passive tasks elicit a clear and simple hemodynamic pattern in all persons. Responses to most stimuli, by most persons, are mixed, with some of the BP elevation due to increased cardiac output and some due to increased resistance. Thus, it is premature at this time to draw strong conclusions; however, the results to date suggest that assessment of these parameters may prove a useful complement to CVR testing.

### **Genetic, Constitutional, Personality, and Situational Effects on CVR**

*Effects of family history of HTN.* A positive family history is a predictor of HTN. Thus, one research strategy has been to see if persons with a family history of HTN tend to exhibit exaggerated CVR to stress. Although some negative findings have been reported, the consensus is that family history of HTN is associated with increased CVR.

*Twin studies.* Several studies have been published that examine the concordance ratios of CVR in monozygotic and dizygotic twins, in children and adults. Overall, there tends to be a stronger relationship between stress reactivity in MZ than in DZ twins, suggesting a stable genetic component. A good example is the NHLBI Twin Study, which has examined twin brothers who were veterans of World War II and the Korean conflict. Reactivity data were obtained from 101 twin pairs; the intraclass correlations of the systolic/diastolic BP changes in response to stress were 0.71/0.56 (MZ) and 0.31/0.23 (DZ). Thus, some proportion of the variance in CVR appears to be attributable to genetic factors.

*Effects of age.* Few studies have examined the effects of age on CVR. For BP reactivity, some studies have shown a positive effect of age, and others have shown no effect. For heart rate reactivity, the results are more consistent: HR responses to stress tend to decline with increasing age.

*Effects of gender.* Men are at greater risk for HTN and CVD during early adulthood and middle age; however, the prevalence of both HTN and CVD increase dramatically in women after menopause, so that among those 75 and older, a greater percentage of women than men have HTN and CVD.

As a result, researchers have examined the effects of gender and of menopause and menstrual cycle in women. The gender comparisons have tended to show

that men exhibit greater systolic BP reactivity to stress, while women tend to have slightly greater HR responses.

*Menopause.* Few studies of premenopausal versus postmenopausal women have been conducted. However, the data that do exist suggest that postmenopausal women tend to have greater HR and systolic BP reactivity than premenopausal women.

*Menstrual cycle.* Several studies have examined this factor, and the results have been inconsistent. Studies employing a between-subjects design have found little or no effect of the phase of menstruation (the luteal or follicular phase) on CVR; studies that have used within-subject designs have tended to show positive results, but the effects have not been large. Katherine Stoney analyzed the results across studies, and suggests that these influences probably do not represent a large influence on CVR (Stoney, 1992). However, she also notes that it is possible that reproductive hormones may play a role in modulating the stress responses in women with abnormal menstrual cycles, and that large changes in hormonal levels may play a role in stress reactivity.

*Effects of race.* Black Americans are at greater risk for the development of HTN and CHD than Whites; however, the cause of this disparity remains unknown. As CVR is postulated to be a mechanism that influences the development of HTN and CHD, several researchers have compared CVR in Blacks and Whites. Some studies have examined Black-White differences to standard laboratory stressors, such as mental arithmetic, and found mixed results, although a preponderance of these studies have shown that both Black children and Black adults exhibit larger cardiovascular responses to these stressors. A handful of studies have used a stressor that involves racial discrimination. The results have been inconclusive, with some studies showing Blacks having greater reactivity to the stressor and other studies showing null results.

These findings highlight the role of generalizability: It is possible that differences in *magnitude* of the responses between Blacks and Whites may not exist; however, it is also possible that differences in the *frequency of occurrence* of reactivity responses may be greater in one population. Thus, the laboratory may provide only limited information regarding the possible pathogenicity of CVR; instead, field methods, such as ambulatory BP monitoring, may be more appropriate for this purpose.

A recent review by Norman B. Anderson points out that recent findings concerning differences in hemodynamic patterns between Blacks and Whites provide an intriguing possible explanation of differences in risk for cardiovascular disease. Some researchers have found that Blacks have a tendency to respond to stressors with elevations in peripheral vascular resistance, compared to Whites, who tend to respond via increased cardiac output, and that this difference may represent a pathway for development of disease. However, this research is in its early stages, and more work must be done before strong conclusions can be drawn.

*The Type A behavior personality (TABP).* The study of CVR was given impetus by evidence linking the TABP (and one of its components, hostility) with exaggerated CVR. This literature has been extensively reviewed (e.g., see the excellent review by B. Kent Houston, 1988); the results are summarized below.

The strongest associations between the TABP and CVR have been observed using the Structured Interview (SI), which is designed to elicit annoyance and impatience. Sex differences in these relationships have been observed. In males, relationships have been observed in the majority of studies in two types of situations: those that involve harassment of the subject, and those in which there exists a moderate incentive to accomplish the assigned task when the task is difficult, but not extremely difficult (a situation that may lead to helplessness).

For women, however, the TABP, assessed using the SI, has not shown the same associations. For middle-class White women, the associations are most likely to occur when using experimental scenarios that involve verbal exchanges; however, this relation has not been observed for women of lower socioeconomic status (SES) or Black women.

The pattern of results when using a self-report Type A measure, the Jenkins Activity Survey (JAS; which correlates poorly with the SI) have been somewhat different. For men, the TABP has been found to be associated with CVR elicited by tasks that require a fast response time and that are difficult but not impossible. Unlike with the SI, CVR in men does not appear to be associated with tasks that involve harassment; this may be due to the fact that there are relatively few anger-related items on the JAS. For women, little association has been observed between the TABP (assessed using the JAS) and CVR.

Karen Matthews, a leading theorist in the interpretation of the TABP, has suggested that the evidence for a relationship between the TABP and CHD incidence is strongest when the SI is used as the assessment tool and when healthy males are the target population. Thus, the relationship between the TABP and CVR may reflect the epidemiological evidence concerning CHD risk.

*Hostility.* The association between TABP, CHD, and atherosclerosis has been mixed, and many theorists now suggest that only some of the characteristics of the TABP are related to heart disease. It now appears that it is the hostility-anger dimension that is most likely to be involved as a component of cardiovascular disease.

Several researchers have focused on the association between hostility, as a personality trait, and CVR. The recent literature suggests that persons who score high on trait hostility tend to exhibit larger cardiovascular responses than low-hostile persons, but only in situations in which this aspect of personality is relevant, such as when the subject is being harassed while working on a stressful task. This is noteworthy because it undermines the idea of reactivity as a generalized trait construct; that is, the trait may influence reactivity only in some situations and not in others. To the extent that CVR is considered a mediator of the stress-HTN/CHD relationship, it is important to consider the degree of exposure. Thus, a hostile person who is not often exposed to situations in which unpleasant social interactions occur will presumably be at no greater risk for development of cardiovascular disease than a nonhostile person.

*Situational determinants of CVR.* In the past two decades, some researchers had begun to take a different approach to the study of CVR. Rather than regarding CVR solely as a function of the person, the role of situational factors, and their interaction with person factors, have also been examined. The increased reactivity in high-hostile persons, but only during unpleasant social interactions, illustrates this. Other situational influences include the nature of the task. As noted earlier, a task that calls for active coping produces a different hemodynamic pattern than a stressor that does not; in addition, several studies have reported differential effects on reactivity due to manipulations of controllability of task outcomes. Researchers have found that the presence of a supportive

person during stress exposure may *attenuate* CVR. These situational manipulations represent an important development in the reactivity model because, unlike the person models, they directly address the issue of frequency of exposure.

### New Developments

For almost a half century after the seminal studies by Hines and Brown, CVR was regarded as the primary pathway by which psychosocial factors affected cardiovascular disease. In the past two decades, however, researchers have grown increasingly sophisticated regarding multiple pathways that may be implicated in this process, including neurohormonal changes, platelet reactivity, and inflammation. Stress may affect all of these physiological processes, which in turn all appear to play a role in the development of heart disease (although the role they may play in the development of HTN is less clear). The understanding of the role of CVR will advance as it is considered in the context of the multiple influences on cardiovascular disease.

Finally, the CVR paradigm itself has been extended in recent years. Although researchers tended to focus on the cardiovascular changes that occur *during* exposure to a stressor, more recent data suggest that the return to the prestress resting level (see Figure 1) may also have a role in predicting cardiovascular disease. It is worth noting that the seminal first reactivity study by Hines and Brown, performed in 1932, anticipated this development; they found that hypertensive patients not only exhibited greater BP responses to the stressor but were also slower to recover.

### Limitations to the Reactivity Hypothesis

There are two major limitations to the reactivity hypothesis as it is commonly proposed. It has been used to explain how chronic or repeated psychosocial stress can lead to HTN and CHD. By definition, this is a complex process with multiple stages, ranging from the nature and frequency of the stressors, how they are perceived, what physiological effects they have, and how the cumulative effect is implicated in the development of cardiovascular disease. CVR to stress is a small part of this chain, and ignores the multiple processes that are involved. The second issue concerns the nature of the relationship between CVR

and cardiovascular disease. The fact that reactivity predicts the development of HTN or carotid atherosclerosis does not by itself mean that it has a causal role, since it is possible that reactivity is a marker for some other process. For example, although reactivity is commonly studied using psychological stressors, there is no evidence that reactivity to *psychological* stress predicts outcome better than the reactivity to a *physical* stimulus such as exposure to cold, standing up, or exercise, all of which have been shown in some studies to be predictive.

There has recently been much interest in endothelial dysfunction (typically measured as a failure of the arteries to dilate in response to ischemia) as a possible causal factor in the development of HTN and heart disease. Indeed, persons who show an exaggerated pressor response to laboratory stressors also show an impaired vasodilator response to ischemia, which may suggest that CVR may be a marker of endothelial dysfunction, and that the latter may be both a cause and a consequence of cardiovascular responses elicited by stress.

### SUMMARY AND CONCLUSIONS

The study of CVR has played an important role in elucidating the role that physiological responses to stress may play in the development of HTN and CHD. It has provided a framework that has evolved since its inception to encompass a broader picture of the multiple processes that are involved in the development of cardiovascular disease. Thus, the models have been broadened to encompass processes such as neurohormonal responses to stress as well as endothelial dysfunction. And other processes, including the role of heart rate variability, platelet reactivity, and inflammation, all of which show changes in response to stress, are being incorporated into the picture of how the body responds to psychological stress and what role these adjustments may play in the development of HTN and CHD.

—William Gerin, Thomas G. Pickering, and Amy R. Schwartz

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See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
 CARDIOVASCULAR PSYCHOPHYSIOLOGY: MEASURES;  
 GENERAL ADAPTATION SYNDROME; HOSTILITY:  
 PSYCHOPHYSIOLOGY; METABOLIC SYNDROME AND STRESS;  
 PSYCHOPHYSIOLOGY: THEORY AND METHODS; STRESS:  
 BIOLOGICAL ASPECTS

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## CAREGIVING AND STRESS

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The role of caregiver to older people in this society is well documented, and those receiving care often have both physical and cognitive limitations. It is also

well documented that caregiving is more often stressful than nonstressful. This stress may increase for caregivers in the future, given that over the next several decades the prevalence of cognitive impairment among older people is expected to increase while physical limitations are expected to remain the same. Furthermore, with the projected increase in the aging population of the United States by the year 2050 (those over age 65 will increase to 20.3%), examining the role of caregiving has become a more critical issue. The importance of this issue is even more significant when we examine the projected increase of racial/ethnic minority elders in the future; it is expected that this group of elders will increase at a much higher rate than non-Hispanic White elders over the next 50 years. From 2000 to 2050, projections indicate that the White elderly population will double and the African American elderly population will quadruple. During this same period, the Hispanic elderly population will increase seven times, the Asian/Pacific Islander elderly population will increase six and one half times, and the elderly American Indian population will increase three and one half times their current numbers.

These figures not only denote a growth in the aging population, they also speak to a growing population of potentially dependent elders in the future, who, like those today, will require care. Most often care is provided in the home by close relatives (spouses and children), who often care for older family members with multiple health problems. Although giving care is not necessarily stressful, a large amount of research information clearly shows that most caregivers experience both the physical and emotional stress effects of caregiving. Other findings show that coping with the stress of caregiving can vary, based on factors such as race, gender, and a number of cultural beliefs and values.

## DEFINING STRESS

Stress has been defined as (a) a demand (environmental, social, or internal) that requires individuals to readjust their usual behavior patterns and (b) enduring problems that have the potential for arousing threat and involve the perception of threat to one's well-being. Stress can threaten the ability to cope and/or adjust, and individuals may become overwhelmed. Researchers have found that the stresses of everyday life can exert a cumulative impact on health.

In the general population, women and people of lower socioeconomic status report higher levels of

stress. Among caregivers, those family members and friends who provide, arrange, or oversee services for older adults with functional disabilities or health needs report higher levels of stress and distress than in the general population. These higher levels of stress are found in community-based caregivers as well as caregivers providing care to institutionalized care recipients. However, similar to the general population, caregivers who are women and people with lower socioeconomic status report higher levels of stress.

It is generally accepted that stress is a multidimensional construct. It is negatively associated with the well-being outcomes of life satisfaction and health and positively associated with depression and placement of the care recipient in a long-term care facility. Caregiving variables associated with an increase in stress include the care recipient's level of need, typically measured as limitations in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), time in the caregiving role, and coresiding with the care recipient. Researchers also document that caregiving is more stressful when caring for a cognitively impaired care recipient. While we generally accept that stress is multidimensional, differentiating stress from burden and strain remains a problem.

Providing care to a chronically ill or disabled family member often involves physical tasks such as lifting, dressing, and bathing. Such constant, and often progressively difficult, caregiving tasks can fill a caregiver's available time and make it difficult to fulfill other obligations. The chronic nature of caregiving, along with the time and physical demands, lead many caregivers to appraise caregiving as a burden, or as stressful. Some researchers have proposed that this appraisal of caregiving as stressful is most likely found in U.S. White culture. They further propose that other cultures would be more likely to appraise caregiving as a natural extension of family life, rather than an interruption of the individual life of the caregiver. Other studies have documented that African American caregivers appraised caregiving as less stressful than White caregivers.

## SITUATIONS CREATING STRESS

Appraisals of caregiving as stressful, and the relationship of caregiving to stress, depend on many variables. Other family roles and competing demands are associated with higher levels of stress, as is an increase in financial difficulties. In addition, as the

disability level of the care recipient increases, so do reports of higher levels of stress. Consequently, social support from others in the caregiver's social network, or from a formal network of helpers (e.g., home health workers), can lessen the stress associated with providing care. Religion and/or spirituality are also documented to help reduce the stress associated with caregiving. African American caregivers have reported God as a source of help, and typically score higher than White caregivers on measures of prayer and comfort from religion. Behaviors such as smoking and changes in weight have also been acknowledged as ways individuals cope with stress. Female caregivers typically report higher levels of stress than males, and caregivers who spend more hours providing care, and those with poorer health, rate their stress as higher than their counterparts.

In addition to poorer emotional health outcomes, higher levels of stress are recognized as detrimental to physical health. Stress is associated with higher levels of blood pressure and heart rate, and is implicated in the development of cardiovascular disease. Lower immune system response, as well as impaired endocrine function, have also been associated with increased stress levels, especially among older caregivers.

## COPING WITH THE STRESS EFFECTS OF CAREGIVING

Current findings show that caregivers use a range of coping styles to address the stress of caregiving, and that these styles vary across diverse groups. It has been found that American Indian caregivers were more likely than White caregivers to use stress management strategies, especially the passive forbearance strategy. In addition, African American caregivers reported using more emotion-focused strategies than White caregivers. Research findings show that African American caregivers reported higher levels of avoidance coping and lower levels of approach coping than White caregivers; these levels of coping were associated with greater negative effects (increased depression and decreased life satisfaction). However, others have found no significant differences in the use of different coping strategies between African American and White caregivers.

One researcher reported that quality of social support predicted confrontive coping, appraisals of perceived rewards predicted palliative coping, and appraisals of perceived costs predicted emotive

coping. It was also found that urban African American caregivers used more behavioral coping strategies than rural African American caregivers. As well, urban African American and White caregivers used more cognitive coping strategies than rural African American and White caregivers. Using an existentialist framework, researchers have found that provisional and ultimate meaning (positive psychological resources that may be used for coping) were higher for African American caregivers than for White caregivers, whereas the effects of provisional and ultimate meaning on negative outcomes were the same for African American and White caregivers.

In recent years, researchers have increasingly examined the role of spirituality and religiosity in understanding how caregivers cope with the stresses of caregiving. A number of studies have reported that African American caregivers cope with difficulties of caregiving with prayer, faith in God, and religion. It has been reported that African American caregivers, unlike White caregivers, reported God to be a part of their informal support to the same extent as family, friends, and neighbors. Some researchers have found that 80% of the African American caregivers reported that prayer, faith, and/or religion was their special way of coping, whereas none of the White caregivers offered those answers. It was found that a palliative coping strategy of prayer/divine trust was used more often than any other coping strategy by African American caregivers. In addition, African American caregivers reported higher religiosity than White caregivers, although religiosity influenced perceived caregiver rewards for both groups. Others, though, have found no difference between African American and White caregivers in assessing the use of spirituality and religiosity in coping with the stresses of caregiving.

The use of social support (both informal and formal), which is an explicit form of active coping, is often used by caregivers. Similar to other coping strategies, different groups may differ in their use of social support. Some researchers report that White caregivers use formal social support as a way of coping with caregiving more than African American caregivers. Conversely, no difference was found in the formal support between African American and White caregivers. Some researchers have found no difference between African American and White caregivers' use of, or satisfaction with, informal support as a way of coping with the demands of caregiving, but they found that White caregivers were more likely

than African American caregivers to report seeking guidance and support as a form of behavioral coping.

## THE ROLE OF APPRAISAL IN COPING WITH STRESS

How one appraises a situation can influence the ability to cope with a stressful situation and the style of coping that may be used. Findings show that African American caregivers tend to use more positive appraisal than White caregivers when dealing with the difficulty of caring for a dependent elder. It was also found that positive appraisal was effective in reducing stress for African American caregivers, but not for White caregivers. Additional research found that caregivers' appraisals and other coping responses mediated the effects of race on well-being. Their findings also show that African American caregivers appraised self-care problems, as well as memory and behavior problems, as less stressful than did White caregivers. However, it was found that African American and White caregivers were similar on indices of appraisal. Finally, findings show that older African American caregivers with lower education were more likely to appraise caregiving as rewarding.

## SUMMARY

We propose that an important next step for researchers and practitioners is to more carefully examine the diverse worlds of caregivers to identify and examine stress effects of caregiving. Furthermore, much more information is needed to help design and implement culturally competent interventions to help caregivers cope with the stresses of their role. For some groups, stress effect interventions may be more related to cultural rather than socioeconomic issues; for others, stress effects may relate to gender issues, or it may be a combination of factors. Findings in the literature point to potential cultural factors that may affect whether one views caregiving as stressful or not. The appraisal of the situation can thus affect whether the situation is perceived as stressful or not. Therefore, more attention is needed when designing interventions for caregivers regarding the mechanisms and pathways through which culture shapes appraisals of the caregiving experience.

—Peggye Dilworth-Anderson  
and Sharon Wallace Williams

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## CENTER FOR THE ADVANCEMENT OF HEALTH

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The Center for the Advancement of Health ([www.cfah.org](http://www.cfah.org)) works to ensure that knowledge about where we live, how we are educated, and what we eat, drink, breathe, and do is used to improve health. As such, the Center is a facilitator and advocate for linking research policy and practice. It does its work by

- Synthesizing research findings and their implications for practice, policy, and future research
- Mapping the dynamics of the issue and determining the following: Who is accountable for solving a specific health problem? What information would help them do so more effectively? How do they currently use science and what are the barriers to using it?
- Facilitating long-term working relationships between scientists and stakeholders to ensure better alignment of science with practice interests
- Communicating research findings to key target audiences, including professional groups, voluntary organizations, Congress, and the public
- Convening leaders to take collaborative action in support of efforts to translate health research into policy and practice

## AN EXPANDED VIEW OF HEALTH

The Center was founded and funded by the John D. and Catherine T. MacArthur Foundation. It is independent and is not aligned with disciplinary, professional, or partisan positions. It has broad subject matter expertise in the behavioral and social sciences and health. The Center maintains long-standing relationships with professional and research societies, science and policy leaders, academic institutions, health nonprofits, foundations, and state and federal government. Its reputation as a neutral convener and a fair and trustworthy partner allows disparate factions to find ways to work together.

The Center, through 10 years of careful investigation and analysis, has explored how and why behavioral and social science on health is underreported and underused in personal, professional and policy decisions. It has drawn attention to the value of using this knowledge in developing effective interventions to improve health and quality of life. And it has contributed to achieving such improvements by working



with the news media, HMOs, insurers, companies, and governments to apply this evidence to the development of their policies, to health care delivery practices, and to the everyday health choices of individuals.

## HEALTH BEHAVIOR NEWS SERVICE

One strategy the Center uses to bridge the gap between research and public knowledge about health is the Health Behavior News Service (HBNS), the aim of which is to focus media attention on behavioral and social determinants of health by promoting scientific developments as news.

The need for the news service came out of the recognition that the heavily funded promotion of biomedical and pharmaceutical science leads to an unintended bias in the news media toward reporting predominantly on biological aspects of health as opposed to balanced reporting that includes the economic, social, and behavioral components of health. This, in turn, presents a dangerously inaccurate picture of what produces disease, and it contributes to a narrow focus on high-tech, expensive fixes with questionable impact.

Science and communications experts at HBNS cull the best new research from more than 30 behavioral and social science journals and translate articles into clear and concise news stories, which are then distributed electronically on an embargoed basis to health reporters. Among the topics HBNS reports on are addictions, adherence to medical advice, aging, cardiovascular health, chronic illness, depression, diabetes, diet, exercise, HIV/AIDS, social determinants of health disparities, and stress.

The news stories are routinely picked up by the Associated Press, Reuters, UPI, and by major publications, including the *New York Times*, *USA Today*, *Los Angeles Times*, *Washington Post*, *Chicago Tribune*, and *Parade* magazine. Journalists and the public may access these stories and briefings from the HBNS's Web site ([www.hbns.org](http://www.hbns.org)). The HBNS also publishes and distributes by e-mail a daily digest of health and behavior articles appearing in the nation's major news media.

The stories inform not only the news media and the general public but doctors and policymakers as well. Unfortunately, many doctors are too busy to read the journals of even their own specialty, and they keep current by reading or listening to the medical reporting

of such major outlets as the *New York Times*, *Chicago Tribune*, *Wall Street Journal*, CNN, and National Public Radio—media that have come to rely on the Center as a credible broker of news about behavior and health.

## Other Publications

Because many journalists lack the time to track and report comprehensively on complex biobehavioral and psychosocial issues, the HBNS also publishes a monthly report called *Facts of Life*, which summarizes a range of research relevant to a given health topic for use as background material for reporters and as copy that can be used whole or in part. Recent topics have included migraine headache, fibromyalgia, posttraumatic stress disorder, and obesity—all from the point of view of how behavior influences our health.

And through an electronic newsletter, the HBNS reaches thousands of members of the scientific community with news about funding opportunities, relevant government policy, and interdisciplinary research.

The Center for the Advancement of Health recognizes that while reporters need to know more about science, researchers also need to know more about reporters. As a result, the Center published in 2000 a popular pamphlet, *Communicating Health Behavior Science in the Media: Tips for Researchers*. It was a compilation of the best advice available from reporters themselves and communications professionals. In recent years, the Center has presented workshops for researchers to help them develop media outreach skills and strategic plans to get their research into the hands of the people who need it—the public.

—Jessie C. Gruman

See also CENTERS FOR DISEASE CONTROL AND PREVENTION;  
HEALTH AND BEHAVIOR ORGANIZATIONS; NATIONAL  
INSTITUTES OF HEALTH: HEALTH AND BEHAVIOR RESEARCH;  
RESEARCH TO PRACTICE IN HEALTH AND BEHAVIOR

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## CENTERS FOR DISEASE CONTROL AND PREVENTION

The mission of the Centers for Disease Control and Prevention (CDC; 2003), the nation's leading agency for public health, is to make people safer and healthier. Headquartered in Atlanta with a workforce of over 8,500 employees across the country and throughout the world, CDC works to promote health and quality of life by preventing and controlling disease, injury, and disability. This work is accomplished through the many partnerships that CDC has developed with both public and private entities. By working with other health and community organizations, CDC carries out surveillance, monitoring public health standards, detecting and investigating health problems, conducting research to enhance prevention, developing and advocating sound public health policies, implementing prevention strategies, promoting healthful behavior, fostering safe and healthful environments, and providing leadership and training. Because disease permeates borders in an increasingly mobile world, CDC has a critical role in protecting the health of individuals through rapid investigation of disease outbreaks, whether they occur in the United States or in other countries. CDC also provides credible information to enhance health decisions, ensuring that the information is not only up-to-date but is accessible and meaningful to those it is meant to serve.

CDC is one of the major operating components of the U.S. Department of Health and Human Services. CDC's major organizational components respond individually in their areas of expertise and pool their resources and expertise on cross-cutting issues and specific health threats. The agency is comprised of these 12 organizational components:

*National Center on Birth Defects and Developmental Disabilities* (NCBDDD) provides national leadership for preventing birth defects and developmental disabilities and for improving the health and wellness of people with disabilities.

*National Center for Chronic Disease Prevention and Health Promotion* (NCCDPHP) prevents premature death and disability from chronic diseases and promotes healthy personal behaviors.

*National Center for Environmental Health* (NCEH) provides national leadership in preventing and controlling disease and death resulting from the interactions between people and their environment.

*National Center for Health Statistics* (NCHS) provides statistical information that will guide actions and policies to improve the health of the American people.

*National Center for HIV, STD, and TB Prevention* (NCHSTP) provides national leadership in preventing and controlling human immunodeficiency virus infection, sexually transmitted diseases, and tuberculosis.

*National Center for Infectious Diseases* (NCID) prevents illness, disability, and death caused by infectious diseases in the United States and around the world.

*National Center for Injury Prevention and Control* (NCIPC) prevents death and disability from nonoccupational injuries, including those that are unintentional and those that result from violence.

*National Immunization Program* (NIP) prevents disease, disability, and death from vaccine-preventable diseases in children and adults.

*National Institute for Occupational Safety and Health* (NIOSH) ensures safety and health for all people in the workplace through research and prevention.

*Epidemiology Program Office* (EPO) strengthens the public health system by coordinating public health surveillance; providing support in scientific communications, statistics, and epidemiology; and training in surveillance, epidemiology, and prevention effectiveness. EPO manages the Community Preventive Services Task Force work that produces the evidence-based best practices guides (The Community Guide, 2003).

*Public Health Practice Program Office* (PHPPO) strengthens community practice of public health by creating an effective workforce, building information networks, conducting practice research, and ensuring laboratory quality. Within PHPPO is an Office of Extramural Prevention Research that makes investigator-initiated grants on social and behavioral issues in health with a particular emphasis on participatory research approaches to link research and practice.

*Office of the Director* (CDC/OD) manages and directs the activities of the CDC; provides overall direction to, and coordination of, the scientific and medical programs of CDC; and provides leadership, coordination, and assessment of administrative management activities.

CDC performs many of the administrative functions for the Agency for Toxic Substances and Disease Registry (ATSDR), a sister agency of CDC, and one of eight federal public health agencies within the Department of Health and Human Services. The Director of CDC also serves as the administrator of ATSDR.

CDC recognizes the value of the behavioral and social sciences as part of its mission, and these disciplines play a vital role in the work of each center, institute, and office. In 1995, CDC established the Behavioral and Social Sciences Working Group (BSSWG) to raise awareness and to further the integration of behavioral and social science into research and prevention activities. With a membership of more than 300 individuals across CDC and the support of CDC's associate director for science, BSSWG has the following goals:

- To further the understanding and utilization of behavioral and social science at CDC and in public health
- To promote and ensure excellence in CDC's behavioral and social science research
- To facilitate communication, collaboration, and partnership among CDC behavioral and social scientists and other scientists and staff at CDC with an interest in behavioral and social science
- To facilitate CDC's recruitment and retention of behavioral and social scientists
- To further the professional development and advancement of behavioral and social scientists at CDC

The behavioral and social sciences encompass several disciplines, each with a variety of theoretical perspectives to explain events. Disciplines at CDC include sociology, psychology, anthropology, health education, economics, and psychiatry. Both qualitative and quantitative methods are used to understand behavioral and social processes that influence health and illness. Like all research at CDC, behavioral and social science research ranges from basic to applied. Applied research includes evaluation studies to examine the effectiveness of existing programs and the development, design, testing, and implementation of new interventions. Monitoring of key behavioral outcomes through surveillance systems is another common focus of applied research at CDC.

Two examples from the more than 300 research activities at CDC that involve the behavioral and social

sciences illustrate just a small portion of these activities. The first is the Behavioral Risk Factor Surveillance System (BRFSS), which operates out of the National Center for Chronic Disease Prevention and Health Promotion. The BRFSS, a state-based system of health surveys, was established in 1984 in 15 states. Using a standard core questionnaire and monthly telephone interviews, the BRFSS collects data on health risk behaviors, preventive health practices, and selected health conditions from a sample of adults in each participating state. Data are currently collected in all 50 states, the District of Columbia, and three U.S. territories. Key data include information on alcohol and tobacco use, diet, hypertension, injury control issues such as seat belt and bicycle helmet use, vaccination, health care coverage, and participation in cancer screening. Among several uses, the data are important for assessing trends, measuring progress in meeting health objectives, and evaluating programs and policies (BRFSS, 2003).

Another example is Project RESPECT, which was carried out by the NCHSTP. This project was designed to evaluate the efficacy of HIV prevention counseling in changing high-risk behaviors and preventing new sexually transmitted diseases (STDs). A randomized controlled trial was conducted at five inner-city clinics among heterosexual STD patients and included prevention interventions aimed at increasing risk awareness and condom use. Early analyses found that patients who received counseling interventions rather than brief STD messages had significantly higher condom use in the following 3 months and an approximately 30% reduction in new STDs in the following 6 months (Project RESPECT, 2003).

—Deborah Holtzman and  
Lawrence W. Green

See also NATIONAL INSTITUTES OF HEALTH

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## CEREBROVASCULAR DISEASE: PSYCHOSOCIAL ASPECTS

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Stroke is the third leading cause of death and the leading cause of adult disability, affecting an estimated 700,000 new persons a year in the United States. As a disease of sudden onset that damages the brain, stroke has the ability to rapidly and catastrophically throw all the psychosocial features of one's life into chaos and upheaval. To a greater extent than perhaps any other condition, stroke can have profound ill effects on cognition, personality, memory, social functioning, physical functioning, mental health, and work life. We briefly review the progress that has been made in understanding the role that psychosocial and behavioral factors play in the onset and course of stroke and stroke recovery. Attention is also paid to the impact of stroke on psychosocial functioning. Finally, intervention research, while somewhat limited compared to other conditions such as arthritis or heart disease, is briefly reviewed. The theme of this entry is that stroke is an ideal "strategic site" for the study of psychosocial factors and health, and that a greater understanding of the role of psychosocial factors will advance theory, research, and clinical practice in stroke.

### IMPACT OF PSYCHOSOCIAL FACTORS AND STROKE ONSET

In theory, psychosocial risk factors for stroke should be similar to those that have been demonstrated in coronary heart disease. Both conditions arise from vascular disease that can involve thrombosis, hemorrhage, coagulation disorders, and various disease processes that lead to ischemia. However, many of the psychosocial risk factors that have been found to be robust predictors of heart disease have not been clearly demonstrated in stroke. This constitutes something of a puzzle. An example is the work on stress. Factors such as work stress, stressful life events, and so forth have produced very mixed results. Some studies suggest an increased risk for those living stressful lives, but the evidence is generally weak. There is fairly consistent evidence that depression and depressive symptoms are associated with increased risk of stroke, especially for stroke mortality.

### Psychosocial Factors and Stroke Course

While the evidence in favor of an etiologic role for psychosocial factors and stroke is less than clear, a great deal of evidence suggests that a wide range of psychosocial and behavioral factors influence the recovery trajectories of stroke survivors. The main variables that have been studied include social support (especially emotional support), social network ties, and family function broadly defined. The bulk of this evidence suggests that social support from family and friends plays an important role in boosting functional recovery and social participation after stroke. Emotional support appears to be unconditionally positive, whereas instrumental support can be a double-edged sword. High levels of instrumental support are associated with worse outcome in some studies, due perhaps to failure to control adequately for health status or stroke severity, or because high instrumental support means that caregivers are overfunctioning in their role and that patients who are overly protected or understimulated have worse outcomes. Overprotection can also increase the risk of poststroke depression, perhaps by undermining the autonomy of the stroke survivor. The reasons for the strong association between social support and functional recovery are not entirely clear, but appear to be explained by a number of mechanisms, including greater treatment adherence, higher activity levels, better mood, and higher motivation for recovery. A related and strong finding is that the presence of a support network offers robust protection against nursing home placement after hospitalization for stroke.

### The Impact of Stroke and Psychosocial Functioning

Stroke has a significant emotional, social, and economic impact on survivors and their families. Affective and personality changes, aphasia, and cognitive impairments after stroke are the cause of much disruption in family relationships, resulting in heightened conflicts and loss of supportive ties. Family caregivers are at elevated risk for depression, caregiver burnout, social isolation, and increased physical symptoms. Social isolation, decreased participation in leisure activities, and sexual dysfunction appear to be common problems for both stroke survivors and family caregivers. On the other hand, a few studies report positive effects of stroke, in particular on family function and caregiver well-being.

### Psychosocial Interventions Poststroke

To date, at least seven randomized trials have been conducted testing various psychosocial intervention models designed to foster improved outcome after stroke. The results of these trials have, in large part, been disappointing. Two of these trials failed to change the trajectory of recovery, most likely because the interventions occurred too late (12+ months post-stroke). Two other trials were underpowered to detect differences in functional recovery due to small sample sizes. Several of the other larger trials focused on mobilizing formal community-based support services rather than on optimizing the naturally occurring social support found in the family. Given that these community-based programs have themselves not been shown to be effective in promoting more optimal stroke recovery, improved mobilization of these resources may not be an effective strategy. Finally, several of the studies involved relatively low-intensity interventions with fewer than five client contacts or interventions lasting a short time (fewer than 5 months).

### SUMMARY AND CONCLUSIONS

Stroke is a strategic site for the study of the effect of psychosocial and behavioral factors on disease onset and course. While stroke has been studied less extensively than cardiovascular disease, a strong case can be made that psychosocial factors play an important role, especially in stroke recovery. The strongest evidence suggests that an optimal mix of social support and strong social networks is an important component of rehabilitation. The efficacy of psychosocial intervention for stroke prevention or rehabilitation has not yet been demonstrated. More qualitative and quantitative research is needed on the factors that place persons at increased risk for stroke onset, predict poor recovery, or result in improved outcomes.

—Thomas A. Glass and Sara Palmer

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## CHILD ABUSE, CHILD NEGLECT, AND HEALTH

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Both child abuse and child neglect are worldwide problems that impair the health and welfare of children and adolescents. Consequences often impede children's growth and development, and effects can be chronic, sometimes affecting individuals throughout their lifetime. The World Health Organization first recognized child abuse as a major public health problem in 1997, indicating that its elimination is a relatively recent but vital addition to their agenda of improving human health and well-being across the globe.

Perpetration of child abuse and neglect is thought to result from a complex combination of individual, family, community, and societal factors. At the individual level, some characteristics of caregivers who abuse or neglect children include mental health problems, including substance abuse, and a caregiver's own history of witnessing violence or being a victim of child abuse or neglect in the past. At the family level, violence between adult caregivers is a risk for child abuse and neglect. High levels of stress from financial or employment problems are other family risk factors. At the community level, cultural norms

about treatment and nurturing of children may affect the prevalence of child abuse and neglect. For example, widespread acceptance of high levels of community violence and/or use of severe physical punishment has been associated with higher prevalence of child abuse. However, social networks may protect children from abuse and neglect in that they help caregivers provide safer, healthier environments for children. At the societal level, countries engaging in wars or ongoing conflicts have rates of child abuse and neglect that escalate as the conflict grows and mass displacement occurs.

There is ongoing debate over how to define different types of child abuse and neglect in reliable, valid, and useful ways. Four general categories are currently recognized: (1) physical abuse, (2) sexual abuse, (3) neglect, and (4) emotional abuse. The most tragic consequence of child abuse and neglect is death of a child; in 1999, it was estimated that 1,100 children died from abuse and neglect in the United States, reflecting a rate of 1.62 children out of every 100,000 children in the population. This rate has remained stable since 1995.

### CHILD PHYSICAL ABUSE

Child physical abuse is most simply defined as an attack on a child that results in or is very likely to result in an injury. However, other definitions include physical assaults that may not result in physical injury. For example, caregivers may be charged with physical abuse if they use corporal punishment (such as spanking and hitting with objects) more frequently and severely than that allowed by cultural norms for punishment of children. Certain physical acts cause more serious injuries, depending on the age of the child; an infant hit on the head may sustain a serious injury such as a broken skull, while an older child hit with similar force might sustain a bruise. A relatively rare form of child physical abuse is Munchausen syndrome by proxy (also known as factitious disorder by proxy), in which a caretaker feigns illness in the child repeatedly in order to gain attention from medical staff, thereby assuming the “sick role” by proxy. The result is numerous unnecessary medical procedures performed on the child that can be harmful and in some cases fatal.

Although it has existed for centuries, the recognition of child physical abuse as a problem by the medical and public health communities began in 1962

with the publication of a landmark paper called *The Battered-Child Syndrome*. Armed with evidence from decades of studies on fractures and bruises among children, Kempe and his colleagues surveyed hospitals and district attorneys and measured the extent of the problem of injuries inflicted on children by their caretakers. The most recent government estimate of the rate of child physical abuse cases reported to authorities in the United States is 2.5 per 1,000 children.

### CHILD SEXUAL ABUSE

Obtaining consensus on a definition of child sexual abuse is such a challenge that a body of literature exists focusing on just its definition. For the purposes of this discussion, the following definition will be used from the U.S. Federal Government’s Child Abuse Prevention and Treatment Act (CAPTA) (42 U.S.C.A. 5106g):

- The employment, use, persuasion, inducement, enticement, or coercion of any child to engage in, or assist any other person to engage in, any sexually explicit conduct or simulation of such conduct for the purpose of producing a visual depiction of such conduct; or
- The rape, and in cases of caretaker or inter-familial relationships, statutory rape, molestation, prostitution, or other form of sexual exploitation of children, or incest with children.

Current recognition of child sexual abuse as a serious public health issue dates back to several prevalence studies among college and community samples in the late 1970s and early 1980s. Today there are hundreds of studies of its prevalence and consequences. Nationally representative prevalence estimates in the United States range from 0% to 16% among men and 3% to 27% among women as measured by surveys. In 1999, the rate of child sexual abuse cases that were substantiated by government agencies was 1.3 children per 1,000 children.

Repeatedly throughout the 20th century, awareness of the problem of child sexual abuse rose and then was suppressed by the negative reaction it elicited. The most notable example was Sigmund Freud’s 1896 “seduction theory,” which purported that child sexual abuse was the cause of many psychiatric problems among his patients. Under pressure from colleagues, he later recanted his theory and insisted that his

patients' accounts of childhood sexual assaults were fabricated and due to fantasy. Despite the proliferation of scientific findings about child sexual abuse in the 1970s, there was a formidable backlash in the newspapers, courts, and clinics in the 1980s, with critics arguing that child sexual abuse was being overreported and that the problem was overdramatized. Currently, the high prevalence of reported child sexual abuse by Catholic priests and the subsequent protection of these perpetrators by church officials is dominating the media, bringing renewed credibility to the problem as serious and hidden.

## NEGLECT

Childhood neglect may take many forms. At its most basic definition, neglect refers to deficiencies in caretaker responsibilities that result in physical and/or psychological harm to a child. Obligations of caregivers include meeting the basic needs of a child such as providing adequate food, shelter, and clothing, as well as the ability to attend school and receive developmentally appropriate supervision, necessary medical care, affection, and protection from harm. Abusing drugs and/or alcohol during pregnancy is sometimes considered prenatal neglect. Neglect is the source of the most child fatalities and has the highest incidence rate of substantiated cases out of the four categories of child abuse and neglect. In 1999, there were 6.5 cases of neglect substantiated by U.S. government agencies for every 1,000 children.

## EMOTIONAL ABUSE

Emotional abuse, also referred to as psychological maltreatment, is a relatively new area of study in the field of child abuse and neglect. Examples of emotionally abusive behaviors include verbal abuse, belittlement, symbolic acts that terrorize a child, lack of emotional availability by caregivers, and anything else that results in the impairment of a child's developing competence. Allowing a child to witness violence in the home is sometimes considered emotional abuse. Some suggest that emotional abuse takes five forms: rejecting, isolating, terrorizing, ignoring, and corrupting. To become a substantiated case, the emotional abuse must be sustained and repetitive. Substantiated cases of emotional abuse were reported to government agencies in 1999 at a rate of 0.9 per 1,000 children.

## CONSEQUENCES FOR MENTAL HEALTH AND BEHAVIOR PROBLEMS

Child abuse and neglect affect children in many deleterious ways. Numerous studies of maltreated children have found evidence of disrupted growth and development, with deficiencies in emotional, cognitive, and social development as well as in physical development and functioning.

Physical consequences associated with abuse range from minor bruises to burns, broken bones, brain damage, and at its most tragic end, death. Neglect can affect brain development, as well as cause general failure to thrive. Consequences of neglect may take the form of nonorganic failure to thrive in infancy, or as deprivational dwarfism as the children get older but remain small in stature because of the absence of proper nutrition.

There are myriad psychosocial and behavioral consequences as well. If a child is neglected in early stages of development, the lack of attachment between the child and his or her caregiver may affect the child's expectations of adult availability, trust, and social relationships throughout the life course. As children reach adolescence and adulthood, a history of maltreatment may lead to difficulties in school performance and low self-esteem. Participation in high-risk behaviors, including risky sexual behavior, abuse of alcohol and other drugs, and attempting and/or completing suicide, have also been linked to a history of child abuse. Abused and neglected children are at higher risk for arrests as juveniles as well as in adulthood, including arrests for violent crimes. Studies of incarcerated women have shown extraordinarily high rates of child abuse and neglect within prison populations.

Child abuse and neglect are also associated with numerous mental health problems. For example, in a nationally representative sample of the United States, child sexual abuse was associated with 14 subsequent mood, anxiety, and substance use disorders among women, and 5 among men. Conduct disorder, oppositional defiant disorder, depression, and generalized anxiety disorder are a few of the psychiatric problems associated with physical abuse among children and adolescents in a community-based probability sample. Emotional abuse may result in serious mental health problems as well, though its long-term consequences have yet to be studied.

If maltreatment is identified in a timely manner, there are efficacious treatment options that can prevent sequelae from affecting children across their

life span. However, many children never receive treatment. Still, some children and adults are resilient to the negative effects of child abuse and neglect. Protective factors such as strengths and supports both within a child and in a child's social environment may affect this resiliency. Gains have been made in development of efficacious treatment strategies of those who have suffered from child abuse and neglect. However, true primary prevention entails prevention of perpetration of the abusive and neglectful behaviors; research into efficacious primary prevention strategies is currently in infancy.

—Beth E. Molnar

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for the individual and the least amount of disruption of daily life. Implicit in the concept of chronic disease is the idea that no cure for the given illness is available and the condition must be managed to reduce its impact on the patient, family, and society.

Management strategies comprise an individual's means to keep the disease and its effects under control (Clark, 1998; Karoly & Kanfer, 1982). These strategies may be effective or ineffective and may be consistent with clinicians' recommendations or not. Some people left to themselves will derive ways to achieve disease control that physicians or health educators would applaud (e.g., a susceptible asthma patient removing environmental precipitants to symptoms from the living quarters). Many do not (e.g., the person with asthma overusing bronchodilators in an effort to reduce symptoms). Effective disease control requires a strong partnership between patient, family, and clinician and adequate support from the health system and community to the individual who must manage the condition from day to day. Disease management is undertaken in full recognition that actions will not eliminate the disease but reduce its impact, for example, prolong life, enhance functioning, and in some instances reduce costs.

Similar themes run across definitions of chronic disease management by the patient (Creer, Levstek, & Reynolds, 1998; Karoly & Kanfer, 1982). First, 90% to 98% of day-to-day management is carried out by the patient. Second, recommended regimens involve a changing and complex set of behaviors and are not all-or-none phenomena (Glasgow & Eakin, 1998). Third, the context (setting and conditions) in which one manages influences the strategies utilized (Creer et al., 1998). Fourth, effective management by the patient requires a shift from well-established, habitual or automatic but ineffective responses to problems toward systematic long-term effective control. Long-term success entails attention to internal and external factors and use of cognitive processes to increase effectiveness (Karoly & Kanfer, 1982). Fifth, unless psychopathology or severe physical limitation is present, individuals can learn to improve their management of disease (Clark et al., 1986).

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## CHRONIC DISEASE MANAGEMENT

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Disease management means taking actions to ensure the best possible level of health and functioning

### DESCRIPTION

Until chronic diseases became the primary concern of developed countries, both professionals and patients, used to dealing with acute conditions,





**Figure 1** Concentric Circles of Influence

believed and behaved as if the manager of illness was the physician (or other relevant clinician) (Clark et al., 1995; Wagner, Austin, & Von Korff, 1996b). In recent years, however, it has become accepted that patients are the managers of their conditions. Of course, patients cannot do the job alone, as many aspects of disease control lie outside their ability or authority. Figure 1 illustrates the circles of influence on the individual trying to keep the effects of illness to a minimum (Clark et al., 1995).

The most influential is the family (Wasilewski et al., 1988), as members are in closest proximity to the patient and often, particularly in the case of a child, actually perform management tasks on behalf of the patient. Clinical expertise is also central to effective disease management (Clark et al., 2000). Most if not all chronic diseases require partnership between the physician and patient, with the clinician providing the best possible therapeutic regimen as well as the counseling and education that enables the patient to carry

through the clinical recommendations (Clark et al., 1995). The actions of the individual physician (or nurse or related clinical professional) are to a great extent influenced by the procedures of the organizations that provide and/or handle payments for clinical services. The availability, structure, policies, and resources of health provider organizations have a significant impact on how enabled or not a patient is in efforts to manage chronic disease. Other people in the social environment of the person with a chronic condition (work, school, and home) help or hinder effective management, as do individuals and organizations in the wider community. Communitywide policies and resources also have an effect.

The extent to which these circles of influence are mobilized in the direction of conducive and productive support of the person managing illness dictates the degree of disease control. Control is usually measured at an individual level (e.g., level of symptoms or side effects, day-to-day functioning, quality of life) and on a communitywide basis (e.g., rates of morbidity or mortality in a given population).

## RELEVANCE

Effective chronic disease management is of central importance in most countries of the world, even those where infectious disease continues to predominate. Leading causes of death around the world include heart disease, cancer, and stroke. Other diseases, although less likely to lead to early death, are costly in human and economic terms. Arthritis, diabetes, and asthma are good examples, as are Parkinson's disease and cystic fibrosis. HIV/AIDS, although an infectious disease that leads to premature death, is somewhat amenable to therapies that slow its progression and as such is also considered a chronic condition.

The human and economic costs of chronic disease are enormous. In the United States alone, heart disease kills 268 people per 100,000 population each year. Cancer causes the death of 203, and stroke another 61. Chronic obstructive pulmonary diseases kill 46 people per 100,000, diabetes 25, Alzheimer's 17, and kidney diseases 13 (National Center for Chronic Disease Prevention and Health Promotion, 2002). As noted, other diseases significantly debilitate individuals and families and cost billions of dollars annually in direct health service costs and additional billions indirectly because of (for example) missed work or school.

## DISTINGUISHING MANAGEMENT TASKS FROM SELF-REGULATION

Management skills and cognitive and behavioral processes that enable one to learn and use the skills are sometimes confused. To manage a disease, for example diabetes, certain tasks must be undertaken (e.g., determining glucose levels, using and adjusting medicines, engaging in regular exercise). However, the means by which an individual develops the management strategies designed to achieve these is self-regulation. Regardless of disease and the disease-specific tasks required of the individual to manage it, the same underlying cognitive and behavioral processes are likely at work. The person managing the condition must be observant of the factors influencing his or her management efforts, be able to exercise judgment (using some form of criteria) to choose between alternative actions, try out and realistically assess optional management strategies (i.e., determine if actions produce results), and have a sense of confidence in his or her ability to continue the action over time. Increasingly, research suggests that interventions that focus on these underlying cognitive and behavioral processes produce desired outcomes for people with chronic disease.

### Management Tasks of Stakeholders Associated With Disease Control

In considering the functions that comprise disease management, it is helpful to think about the stakeholder groups that take them: patient and family, health care professionals, health service organizations and systems, and communities or, writ large, societies.

*Patient and family tasks.* Central to the control of chronic conditions is the ability of individuals to learn and apply effective disease management strategies (Clark, Gong, & Kaciroti, 2001). Two categories of strategy are needed: those related to (1) prevention of episodes or flare-up of symptoms (e.g., changes in behavioral patterns, physical activity, smoking) and (2) management and reduction of symptoms when they occur.

Effective management by the patient and family evolves from the patient's observations, judgments, and reactions in light of the influence of internal and external factors, an important external factor being clinical recommendations. Implementation and

modification of therapies (medicine related, as well as nonpharmaceutical aspects of management such as diet or exercise patterns or levels of stress) best result from a combination of good medical advice and the patient working out how best to follow that advice on a day-to-day basis. Periodic interaction with the clinician and fine-tuning of the therapeutic recommendations are crucial.

As management of chronic disease by the patient almost always involves tasks using a prescribed medicine, the clinician needs to give the patient guidelines or an action plan to use to adjust medicines at home as needed. Some treatments (e.g., particular diabetes regimens) include complex tasks requiring continuous attention (Enzlin, Mathieu, & Demyttenaere, 2002). Others (e.g., some forms of heart disease) may require only one medicine a day.

When managing a chronic disease, the patient and family must learn enough about its natural history to observe, judge, and react appropriately to management challenges, that is, they must know the critical concepts relevant to disease control and learn the related management skills. The involvement of the family in day-to-day management is more frequently needed when the patient is a child. Even as a child, however, the patient must be allowed to play an active role in his or her disease management to evolve effective prevention and control strategies.

An extensive body of literature describes the role and significant influence of partners, parents, children, and siblings on the management efforts of a chronically ill person. And although families play an important role, most know from personal experience, as well as research, that family members can be a help or can deter disease management (Wasilewski et al., 1988). Disease control entails mobilizing families to be of the most positive help to patients.

*Tasks of health professionals.* Of crucial importance in disease management is the clinical community, particularly the physician primarily providing the patient's medical care. For over 50 years, a voluminous literature on patient-physician relationships has accumulated describing the interactions between the two (Roter et al., 1998). The kind of health care system (Wagner et al., 1996b), the role of the clinician, and the set of clinical skills needed to help enable patients to manage chronic disease (Clark et al., 1995) have been acknowledged as fundamental to a patient's success.

As noted, chronic disease management requires a partnership between the patient and clinician, and disease is unlikely to be controlled unless that partnership exists (Guidelines for the Diagnosis and Management of Asthma, 1997). Yet many in the clinical community need to learn how to assist their patients to manage better (Cabana et al., 2000). This is rarely a major focus of clinical training, even though an accepted and central role for most practitioners is encouraging and enabling effective disease management by their patients.

The goal for the health professional is to enable the patient to keep the condition under the best possible control to prevent deterioration and the negative effects of disease on the patient's physical and psychosocial functioning. When considering how clinicians interact with their chronically ill patients to achieve this end, we can categorize at least three types of clinical tasks. The first task is to tailor the most appropriate and effective therapeutic regimen for the individual. Here it is hoped that the clinician will be aware of and able to use therapies that are the standard of practice.

The second task is communication and counseling. In most chronic diseases, once the optimum medical regimen is determined, the clinician's role shifts from diagnostics and therapies to patient guidance and coaching. The success of the treatment plan (and an important measure of clinical performance) depends on how well the patient manages a disease on a day-to-day basis. Studies have shown that how clinicians interact with their patients influences health outcomes (Clark et al., 2000). Ten techniques clinicians can use have been shown to enhance communication with and generate positive results for patients. Clinicians can achieve results by (1) showing nonverbal attentiveness, (2) giving nonverbal encouragement, (3) giving verbal praise for things done well, (4) maintaining interactive conversation, (5) finding out underlying worries/concerns, (6) giving specific reassuring information, (7) tailoring the medication schedule to the family's routine, (8) reaching agreement on a short-term goal, (9) reviewing the long-term therapeutic plan, and (10) helping the patient to use criteria for making decisions about disease management (Clark et al., 1995).

A third task for the clinician is to provide specific messages that make clear the critical concepts and basic factual information required for patients to understand and follow the therapeutic recommendations.

The problem of providing information that is irrelevant to a patient's personal concerns or information of a type that does not affect behavior has been discussed in the literature (Caplin & Creer, 2001; Creer et al., 1998; Heisler, Bouknight, Hayward, Smith, & Kerr, 2002). In most if not all of the major chronic diseases, there is a core of salient concepts linked to changes in patient behavior that comprise the foundation for management (Heisler et al., 2002; Lorig, Mazonson, & Holman, 1993). These must be provided to the patient.

*Tasks of health care organizations and systems.* There is little doubt that the setting providing patient care and the means by which care is paid for affect the health and functioning of the person with chronic disease. Means by which clinical procedures, supportive services, and other resources are directed to diagnosis and treatment are often referred to as disease management by the health care system.

Deficiencies in the delivery of routine care for patients with chronic illness have been identified as contributing to suboptimal outcomes (Wagner et al., 1996b). These include irregular or incomplete assessment or inadequate follow-up of patients, inadequate or inconsistent patient education and feedback, omission of effective interventions or use of ineffective ones, and failing to detect or inadequately managing a patient's psychosocial distress.

Although few studies have focused on the chronic disease management tasks associated with health care systems, five organizational elements (Wagner, Austin, & Von Korff, 1996a) have been posited as maximally responsive to the needs of the chronically ill. The first element is using evidence-based protocols for managing patients. This element requires a shift in clinical practice away from habit or use of favored but unsubstantiated therapies toward interventions that have been subjected to clinical trials and proven effective. The second is reorganization of practice systems and provider roles. This element requires reconsideration by the health care organization of how to effectively deliver primary care, make appointments, allot clinical time, delegate tasks, manage data, and so on. These planned improvements have been referred to as "practice redesign" (Wagner et al., 1996b). The third is ensuring timely availability of relevant expertise, a factor that is partly dependent on the resources available from insurers for reimbursing the cost of expertise. The fourth element is more

organized and readily available clinical information. This element ranges from making up-to-date data available on individual patients to innovations in telemedicine. The final element is building into the organization improved patient education. Improved patient education includes (a) implementing proven patient education programs, and (b) ensuring that individual education and counseling is provided to patients by clinicians.

A problem in assessing the role and success of clinicians of all types in fostering effective disease management in their patients is that research has not separated the effects of clinical behavior from the organizational features of the practice environment. While both are necessarily entwined, determining the relative contribution of each to important patient outcomes could enhance the design and delivery of interventions.

*Community (society, state, etc.) programs and policies.* As the circles of influence reach beyond families and clinicians to those in the day-to-day environment of the patient, people in the workplace or school need to understand what to do to support individuals with chronic disease. They must act to help in an emergency. They also need to recognize when their coworker or classmate needs some instrumental assistance or just some moral support and encouragement (Israel, Guile, Baker, & Silverman, 1994).

Community awareness and action are also important. Environmental measures are sometimes needed, for example, measures to reduce air pollution and other factors that exacerbate cardiovascular and lung disease. Conducive policy and regulation is needed, for example, enabling people to have access to medical care and to safe and effective pharmaceutical products. The important points here are that individual patients cannot control the range of influential factors on their own, and control of chronic disease goes beyond individual and clinical approaches.

Positive outcomes can result from actions of others in the community with a stake in disease control in support of those managing a chronic condition. For example, effective disease management by school children involves not only children with the illness but also school staff and classmates. Disease management education for children at school and education of their peers without a chronic condition has been shown to positively affect outcomes by creating more conducive social and physical environments (Clark,

2002; Shah et al., 2001). Other community venues work as the sites for enhancing disease management. Norris et al. (2002) reviewed educational interventions and concluded that there was sufficient evidence that these programs improved glucose monitoring by adults with Type 2 diabetes when offered in community gathering places (churches, community organizations, etc.).

Effective policy can greatly assist those with chronic disease. In some parts of the United States, for example, policymakers have changed school practices to allow children with asthma to use their medications at school. A child may be a very fine manager, but school regulations may prevent him or her from managing at the optimum level.

Financial policies can also enable or deter good management. For example, some insurance plans have recognized that related equipment must be available to patients managing disease to ensure a good outcome. In some policies, spacer devices are covered to enable young children with asthma to receive adequate doses of medicine, or essential equipment is made available to diabetics. However, these examples are too often exceptions. In few areas of the country are communitywide support systems and policies, access to high-quality preventive care, and adequate financial arrangements universally congenial to people with chronic disease.

## IMPROVING CHRONIC DISEASE MANAGEMENT

Although some good research has illustrated that individuals with chronic disease can improve how they manage a condition and other stakeholders can learn to be supportive, understanding the potential impact of interventions is limited by insufficient study. For example, a recent review (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002) examined 145 evaluations of programs to enhance management of 30 different chronic conditions. Approximately half of the studies were randomized controlled trials with very small sample sizes (e.g., 20-30 patients) and with short follow-up periods (typically 4-6 months). Such time frames are clearly inadequate, given the duration of most chronic conditions.

Nonetheless, consideration of the potential impact of interventions is aided by the growing interest in the past decade in evidence-based medicine. Much closer attention is paid these days to the actual health

outcome associated with various therapies and interventions thought to benefit patients. An outgrowth of this interest is the Cochrane Collaboration, an initiative in the United Kingdom supported by the National Health Service. The Cochrane Collaboration, by mobilizing researchers from around the world, has developed rigorous methods for searching databases (in all languages), selecting studies using strict criteria for inclusion (essentially well-conducted, randomized controlled trials and controlled clinical trials with adequate sample sizes), analyzing data in a standardized form of meta-analysis, conducting peer review, and making results available not only in peer-reviewed journals but also on the Internet, where periodic updates are provided.

Of late, Cochrane reviewers have turned their attention to disease management by patients, specifically asthma and arthritis. In both instances, interventions reviewed were associated with positive outcomes, for example, reduced hospitalizations, ER visits and unscheduled office visits, fewer absences from work or school, and decreases in symptoms. In short, over the past 20 years, evaluations of interventions to assist patients with the range of major chronic conditions have produced data to suggest that patients, families, and clinicians can be taught to manage disease more effectively. However, study of effective means to help patients is needed especially regarding the organization and financing of clinical health care.

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See also ARTHRITIS: BEHAVIORAL TREATMENT; ARTHRITIS:

PSYCHOSOCIAL ASPECTS; ASTHMA: BEHAVIORAL TREATMENT; ASTHMA AND STRESS; CHRONIC OBSTRUCTIVE PULMONARY DISEASE: PSYCHOSOCIAL ASPECTS AND BEHAVIORAL TREATMENTS; DIABETES: BEHAVIORAL TREATMENT; DIABETES: PSYCHOSOCIAL ASPECTS; FIBROMYALGIA SYNDROME: BIOBEHAVIORAL ASPECTS; FIBROMYALGIA SYNDROME: COGNITIVE-BEHAVIORAL TREATMENT; HEADACHES: PSYCHOLOGICAL MANAGEMENT; IRRITABLE BOWEL SYNDROME: PSYCHOLOGICAL TREATMENT; IRRITABLE BOWEL SYNDROME: PSYCHOSOCIAL ASPECTS; RAYNAUD'S DISEASE: BEHAVIORAL TREATMENT

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## CHRONIC FATIGUE SYNDROME: PSYCHOSOCIAL ASPECTS

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Fatigue is considered a nonspecific symptom because it can be indicative of several causes or conditions. It occurs in many physical and psychiatric

illnesses, as well as in response to medication or medical treatment or to temporary physical conditions or lifestyle. Chronic fatigue syndrome (CFS) has recently emerged as an illness whose primary symptom is chronic fatigue, but it is also accompanied by the various combinations of other symptoms, including sore throats, muscle pains, and unrefreshing sleep. CFS has its origins in the 19th century, with the condition known as neurasthenia. By the late 1800s, neurasthenia was one of the most frequently diagnosed illnesses; however, by World War I, the diagnosis of neurasthenia almost disappeared. By the beginning of this century, medical skepticism concerning this illness increased and neurasthenia began to be viewed as a psychiatric disorder rather than a neurological illness. In addition, neurasthenia patients were increasingly held in low esteem by medical personnel. The debate that occurred about 100 years ago, concerning whether neurasthenia was a disease of the body or mind, has reappeared with CFS.

## CASE DEFINITIONS

The original case definition of CFS, published in Holmes et al. (1988), defined CFS as the “new onset of persistent or relapsing, debilitating fatigue” that was “severe enough to reduce or impair average daily activity below 50% of the patient’s premorbid activity level for a period of at least six months.” In addition, a person had to have 8 or more of the 11 minor symptoms (e.g., sore throat, painful lymph nodes, unexplained generalized muscle weakness). However, use of the original case definition of CFS appears to have produced erroneous estimates of the extent of CFS comorbidity with psychiatric disorders.

In the United States, there was considerable dissatisfaction with the original Holmes et al. (1988) case definition because it was being inconsistently applied by researchers. In 1994, a new CFS definition was published (Fukuda et al., 1994). In this new case definition, a person needed to experience chronic fatigue that had a new or definite onset, that was not substantially alleviated by rest, that was not the result of ongoing exertion, and that resulted in substantial reductions in occupational, social, and personal activities. In addition, there needed to be the concurrent occurrence of four or more minor symptoms (sore throat, muscle pain, etc.). This new case definition required only four minor symptoms, whereas the previous definition required eight. The new definition of

CFS did not exclude people who have purely psychosocial, stress, or many psychiatric reasons for their fatigue. By broadening the CFS definition, it is important to ensure that those patients with solely a psychiatric disorder are not erroneously included within the CFS rubric, as including these types of patients in the current CFS case definition could seriously complicate the interpretation of studies.

## PSYCHIATRIC INSTRUMENTS

The Diagnostic Interview Schedule (DIS), a structured psychiatric instrument designed for use in community surveys, has frequently been used to assess psychiatric comorbidity in CFS samples. Unfortunately, this instrument was not designed for use with medically ill populations. As an example, if several physicians diagnosed a patient as having a medical disorder, but only one attributed the symptom to a psychiatric disorder, the item would be scored to count toward a psychiatric diagnosis. Many physicians still do not accept CFS as a legitimate medical disorder, so it is possible that many patients would have had at least one physician who diagnosed their medical complaints as being a psychiatric disorder, thus increasing the likelihood that people with CFS would receive a psychiatric disorder assessment.

In contrast to the rigid interview structure of the DIS, the Structured Clinical Interview for the *DSM-IV* (SCID) uses open-ended questions and all potential sources of information to encourage a thorough description of the problems by the interviewee. Use of the SCID is also limited to highly trained clinicians. A study by Taylor and Jason (1998) administered the DIS and the SCID to a CFS sample. Of individuals diagnosed with CFS, 50% received a current Axis I psychiatric diagnosis when using the DIS; however, only 22% received a current diagnosis when using the SCID. These findings suggest that high or low psychiatric rates in CFS samples may be a function of whether symptoms are attributed to psychiatric or nonpsychiatric causation.

## Etiology

Rather than conceptualizing CFS solely as a disease of the body or the mind, a biopsychosocial perspective provides a transactional model, one that suggests that complex interactions between multiple biological and psychological factors influence the onset of CFS and pathways to further illness or recovery.

The biopsychosocial model contends that there might be multiple pathways leading to the cause and maintenance of the neurobiologic dysregulations and other symptoms experienced by individuals with CFS. Depending upon the individual, these may include unique biological, genetic, neurological, psychological, and socioenvironmental contributions.

Clauw and Chrousos (1997) suggest that individuals who develop CFS might be genetically predisposed to develop this condition. It has been found, for example, that patients with CFS have parents with increased prevalence of cancer and autoimmune disorders when compared to control patients' families. It was also found that persons with CFS were significantly more likely to report a family history of autoimmune disorders when compared to a control group. Clauw and Chrousos further posit that susceptible individuals might evidence a number of organ-specific illnesses before finally progressing to develop CFS. Supportive data is also available for this thesis, as prior to developing CFS, patients have significantly more upper respiratory tract infections, lethargy, and vertigo than controls. Clauw and Chrousos also suggest that once the individual develops CFS, which can occur abruptly or slowly through viral infections or emotional stressors, there is a blunting of the hypothalamic-pituitary axis and instability of the autonomic nervous system. In patients with CFS, the biological stress response is blunted, and if exercise leads to a further drop in cortisol levels, this postexercise adrenal insufficiency could be responsible for the severe postexertional fatigue that patients frequently experience.

## Epidemiology

The first, and widely publicized, study of CFS epidemiology, from which the estimates above were derived, was initiated in the late 1980s by the CDC. Investigators requested physicians in four cities to identify their patients who had a group of specified fatigue-related symptoms. The minimal prevalence rates of CFS ranged from 2.0 to 7.3 individuals per 100,000 cases. This study was typical of the first generation of CFS epidemiological studies, which were based on physician referrals from hospital and community-based clinics. However, medical sociological studies have indicated that many low-income individuals do not have access to the health care system; therefore, it is inappropriate to estimate prevalence estimates solely from treatment facilities.

A second generation of epidemiological studies have used more community-based samples. As an example, Jason and colleagues (1999) attempted to contact a stratified sample of 28,673 households in Chicago by telephone. Of that sample, 18,675 individuals were screened for CFS symptomatology. The sample was stratified to ensure a representative sample of the diverse ethnic and socioeconomic groups comprising the Chicago general population. Based on the initial screening, participants with significant fatigue and CFS symptoms were selected to receive a psychological evaluation and medical examination. Approximately 0.4% of the sample was determined to have CFS, and rates of CFS were higher among Latino and African American respondents when compared to White respondents. These data suggested that there might be as many as 800,000 adults in the United States with this syndrome, suggesting that it is one of the more common chronic health conditions.

## Nonpharmacological Interventions

Cognitive-behavioral therapy with graded exercise constitutes a form of treatment for CFS, and this nonpharmacological intervention has been suggested as one of the more promising treatment approaches. Cognitive behavioral interventions deal with cognitive restructuring, coping skills, provision of psychological support, and illness education. It is still unclear whether these types of interventions influence the immune system. Miller and Cohen (2001) have proposed that patients might evaluate stressful experience as a significant threat and exceeding coping resources, and this might elicit negative emotional responses. These negative emotional responses cause distressed patients to engage in behaviors (e.g., decreasing physical activity, altering sleep patterns), which conceivably modify immune responses. In addition, negative emotional states might also activate the sympathetic division, whose fibers descend from the brain to lymphoid tissues (bone marrow, thymus, spleen, etc), and these fibers could release substances that influence immune responses. Distress also can activate the HPA axis, and hormonal products from these systems can dysregulate the immune system. Psychological interventions might modify the way stressful circumstances are appraised, and diminish the way negative emotional responses influence immune dysregulation. Relaxation, emotional-regulation training, and learning more adaptive coping responses might also decrease negative emotions.



## CONCLUSION

When a new disease syndrome emerges, such as CFS, studies on diagnostic criteria, epidemiology, and treatment approaches can help shape public policy decisions. Beliefs about the medical legitimacy of the illness may influence federal and state resources allocated for research, prevention, and intervention. Scientists have key roles to play in investigating issues of attribution as they relate to new disease syndromes such as CFS. If inappropriate use of the case definition leads to the inclusion of individuals who have a purely psychiatric condition, this heterogeneity of patients with CFS and psychiatric conditions will present difficulties in interpreting the results of epidemiological and treatment studies. A broad or narrow definition will have important influences on both CFS epidemiological and treatment studies.

—Leonard A. Jason, Susan  
Torres-Harding, and Michael Fries

See also CHRONIC DISEASE MANAGEMENT

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## CHRONIC ILLNESS: PSYCHOLOGICAL ASPECTS

We place the bottom line at the top of this entry: Heterogeneity in adjustment to chronic illness is the rule rather than the exception. That is, adjustment is shaped by many intrapersonal and interpersonal processes and occurs across many life domains. Adjustment to chronic illness represents a process that unfolds over time, a process that cannot be described adequately without understanding the individual's life context. Identifying the psychological processes that affect adjustment outcomes is important for the design of clinical interventions aimed at reducing distress and life disruption.

## DEFINITIONS AND IMPACT OF CHRONIC DISEASE

The National Center for Chronic Disease Prevention and Health Promotion defines chronic disease as "illnesses that are prolonged, do not resolve spontaneously, and are rarely cured completely." According to this broad definition, more than 90 million Americans live with chronic diseases. This number is expected to increase as life expectancy increases and many diseases that were formerly considered as acute, including AIDS, are redefined as chronic. Chronic diseases shorten survival, are the leading cause of disability, and lead to economic, social, and psychological declines. Women, racial minority

populations, and people living in poverty are affected by chronic illness to a disproportionately greater degree.

From a psychological perspective, the definition of chronic illness is complex: When does one stop being a cancer patient? When treatment is completed? When there is no detectable cancer? When symptoms subside? Most medical researchers concur that the disease process must persist over at least several months to constitute *chronic* disease, but there is great variation in the rapidity of onset, degree of life threat, and extent of daily life disruption from symptoms and treatment. Although some of the consequences of chronic disease are sudden and obvious, such as the surgical excision of a body part, others are gradual and insidious, such as losing muscle strength, changes in family relationships, and a changed self-concept.

#### WHAT DOES IT MEAN TO ADJUST TO CHRONIC ILLNESS?

##### **Adjustment Involves Multiple Adaptive Tasks**

Despite the fact that there is wide variation in chronic illnesses, there are several central, common adaptive tasks of illness: keeping distress within manageable limits, maintaining a sense of personal worth, restoring relations with significant other people, enhancing prospects for recovery of bodily functions, managing pain and symptoms, negotiating the medical treatment environment, maintaining adequate relationships with health care professionals, and increasing the likelihood of attaining a personally valued and socially acceptable situation once maximum physical recovery has been accomplished. Shelley Taylor's theory of cognitive adaptation to threatening events emphasizes self-esteem enhancement and preservation of a sense of mastery over one's life, and adds resolution of a search for meaning ("Why me?") as a central adaptive task. Other tasks or goals involve resumption of paid employment or routine activities, mobility, and adherence to a treatment regimen.

##### **Adjustment Is More Than the Absence of Psychopathology**

The most often used markers of adjustment include the presence or absence of diagnosed psychological disorder, psychological symptoms, negative mood, and satisfaction in various life domains (marriage, work). Researchers examine health-related quality of

life in physical, functional, social, sexual, and emotional domains. The negative consequences of chronic illness have been emphasized, because identifying the psychological processes that adversely affect disease outcomes and psychological adjustment is important for designing psychological interventions.

The relative lack of attention to more positive outcomes has persisted until recent years, despite early observations that "many patients are remarkably resourceful even in the face of a catastrophic situation" (Hamburg & Adams, 1967, p. 278). Indeed, positive adjustment may more accurately represent the experience of most individuals with chronic illness than does psychopathology. Studies of long-term cancer survivors suggest that the greatest degree of distress and life disruption occurs within the first year after diagnosis (during initial treatment), with global adjustment indicators resuming pre-illness levels after that.

Researchers who study posttraumatic growth and resilience challenge the assumption that good adjustment is defined by a return to pre-illness levels of mental health or physical functioning. Instead, individuals can experience growth in self-awareness, interpersonal relationships, and enjoyment of life, or even make quantum life changes. Echoing many other personal accounts, three-time Tour de France winning cyclist Lance Armstrong said that cancer was the best thing that ever happened to him, as it made him take his sport more seriously. Through efforts to find meaning in their illness, many people with chronic illness are able to thrive and not simply survive.

##### **Adjustment Is a Dynamic Process**

As treatment demands, disability, and prognosis change over time, so do the adaptive tasks of illness. There is little evidence that adaptation follows a linear path. Medical advances (e.g., the development of anti-retroviral therapies for AIDS), unexpected changes in disease progression (e.g., a cancer recurrence or an arthritis flare), and shifts in the individual's life context (e.g., taking on new family or work roles) create more circuitous pathways to adaptation. Interpersonal interactions with friends and family also change over time, and can alternate between periods of relative independence and dependence. Thus, adjustment to chronic illness changes over time because of changes in one's medical situation, personal relationships, and life circumstances.

### Adjustment Must Be Embedded in the Life Context

Adjustment to chronic illness can be understood only in conjunction with the life context in which illness occurs. Demographic characteristics such as gender, age, and social class provide us with culturally acceptable modes of coping as well as constraints on one's coping repertoire. For example, processing and expressing emotions is more adaptive for women in particular contexts in part because it is seen as more socially appropriate. The onset of an illness that is "off-time" in the normative adult life cycle (e.g., being diagnosed with Parkinson's disease in your 30s) is likely to be more stressful than when the illness occurs "on-time." People are not prepared for the sudden life or bodily changes that illness brings, and relatively few age peers are experiencing the same life situation, so there are fewer individuals with whom to share concerns.

### Heterogeneity in Adjustment as the Rule

Research reveals substantial diversity in individuals' adjustment to chronic illness, with most reporting generally positive adjustment and the minority evidencing significant distress or life disruption. Few people with chronic disease manifest clinical levels of psychological dysfunction, although rates vary widely across studies. Chronic disease is likely to carry a more circumscribed impact for most people. Barbara Andersen has observed that cancer is more likely to produce "islands" of life disruption in particular life realms and at specific times than it is to result in global and persistent maladjustment.

## DETERMINANTS OF ADJUSTMENT TO CHRONIC ILLNESS

### Cognitive Appraisals

How individuals view their illness is a central determinant of subsequent actions, emotions, and adjustment. Cognitive appraisals include the degree of threat and potential for harm that the illness presents, how changeable or controllable the illness is, and a self-evaluation of one's coping resources. A man who believes that his diagnosis of prostate cancer is a death sentence is likely to make very different decisions regarding treatment than one who sees his cancer as curable, and the two men are likely to manifest distinct adjustment trajectories.

Perceiving a sense of control or mastery over one's life in general is associated with better adjustment outcomes unless the illness is medically uncontrollable, when relinquishing control is advantageous. Sense of control has predicted less angina in patients following coronary artery bypass grafts and better functional status following osteoarthritis surgery. Control appraisals also influence the choice of coping strategies; higher perceived control is associated with the use of more approach-oriented coping strategies. However, choosing a controllable target makes a difference: Cancer and arthritis patients' belief that they could control daily emotional and physical symptoms was a stronger predictor of adjustment than was perceived control over long-term disease progression.

### Coping Processes

How one copes with the illness makes a difference. Coping efforts may be focused on solving or minimizing concrete problems or directed toward managing the emotional distress created by those problems. Approach-oriented or active coping processes include information seeking, problem solving, seeking social support, actively attempting to identify benefits in one's experience, and creating outlets for emotional expression. Avoidance-oriented coping processes involve both cognitive (e.g., denial, distraction, suppression) and behavioral strategies (e.g., behavioral disengagement). Other processes, such as spiritual coping, potentially can serve either approach-oriented or avoidance goals.

The use and effectiveness of particular coping strategies are likely to vary over time and across specific adaptive tasks. Although avoidant coping may be useful at specific, acute points of crisis, it typically is associated with poorer adjustment over time. Coping through avoidance may involve harmful behaviors (e.g., alcohol use) that may impede other more effective coping attempts. Approach-oriented coping strategies often result in more positive adjustment outcomes, perhaps because they afford a sense of control.

### Personality

Personality or person-centered variables affect adjustment directly and through their influence on appraisal and coping processes. *Dispositional optimism*, or generalized expectancies for positive outcomes in life, has been related to both greater use of

problem-focused coping strategies and fewer symptoms of depression among ischemic heart disease patients, coronary artery bypass graft patients, early-stage breast cancer patients, and HIV-positive men. *Self-efficacy* (best exemplified by the motto of the Little Engine Who Could: "I think I can, I think I can") is also advantageous, predicting better management of symptoms, less pain, greater adherence to prescribed treatment, and more positive mood.

*Neuroticism* involves chronic negative affect (including anxiety, tension, sadness, frustration, and irritability) coupled with low self-esteem and high self-consciousness. Individuals high on this trait tend to complain of more symptoms, and it has been linked to increases in blood pressure, the development of coronary heart disease, premature mortality, length of survival, and, among HIV patients, more rapid deterioration of the immune system.

### Social Support

Most of the adaptive tasks of chronic illness require help or feedback from others. Thus, patients need an available and satisfying network of interpersonal relations on which they can count for both emotional sustenance and more practical help during periods of pain, disability, and uncertainty.

*Social support* refers to the processes by which interpersonal relationships promote psychological well-being and protect people from health declines, particularly when they are facing stressful life circumstances. Supportive behaviors can involve demonstrations that one is loved, valued, and cared for, and the provision of helpful information or tangible assistance. Although social support should not be dependent on network size, the networks and social activities of ill or disabled individuals are often restricted.

A wealth of research over the past two decades has demonstrated that interpersonal relationships are a strong predictor of adjustment to chronic illness. Patients receiving more support from friends and family exhibit greater self-esteem and life satisfaction, cope more effectively, and exhibit fewer depressive symptoms. This is robust across populations with different illnesses and of different durations. Social support operates through a number of physiological and cognitive pathways. Social support enables recipients to use more effective coping strategies: It helps patients come to a better understanding of the meaning of their illness, it increases motivation to take

instrumental actions, and it reduces the tension and emotional stress that may impede other (more effective) coping efforts.

Social support is most beneficial when it matches the characteristics of the stressor faced. For example, a recently diagnosed patient may desire concrete information to make a medical decision; a more disabled patient may prefer help with activities of daily living combined with companionship. *Who* is providing support also is important: Chronically ill people prefer to receive emotional support from family and informational support from medical personnel.

Most research has focused on the benefits of social support. But receiving, using, or requesting support has its costs. Patients experiencing pain and disability are very vulnerable to the effects of critical comments. The perception of network members as unreceptive to efforts to discuss stressful or traumatic events has been referred to as *social constraints*. Discussing stressful circumstances in a supportive, uncritical social environment allows people to process their emotions, maintain or reestablish a positive self-concept, and find meaning in the illness. Persons with breast, colon, and prostate cancer and persons with rheumatoid arthritis who perceive that others are unreceptive to hearing about their experiences have poorer psychological adjustment.

### Macrolevel Contextual Factors

Previously, we suggested that adjustment to illness must be understood in conjunction with the life context in which illness occurs. Several macrolevel factors have been shown to affect adjustment, including socioeconomic status (SES), culture, ethnicity, and gender. SES and race most likely affect adjustment indirectly through their influence on key environments, including the physical environment in which one lives and works and the social environment of interpersonal relationships. Studies of chronic illnesses such as cancer, heart disease, and arthritis have found that women are more strongly affected by the illness, even more so when they are in the caregiver role. But because many diseases vary in their prevalence among men and women, most studies sample respondents of only one sex, so we can't easily untangle gender effects.

Cultural worldviews supply blueprints for adaptation to illness—how meaning is given to events and which behaviors are appropriate in which situations. Culture determines whether one should follow the

advice of traditional medical providers or turn to culturally sanctioned healers (e.g., *curanderas*, *yerberos*). Cultural blueprints also shape cognitive appraisals of illness, guide treatment decisions, and determine how illness is expressed. For example, in Latina cultures, the condition of *nervios* blurs the distinction between physical and mental illness, and in some societies with high poverty rates or totalitarian governments, the expression of illness is a behavioral manifestation of powerlessness, particularly among women. Culture also may define the acceptability of particular coping responses, such as emotional expression or anger, and thus limit their value as adaptive mechanisms.

## SUMMARY

Chronic illness affects psychological and social functioning, but psychological and social variables also shape an individual's adjustment to the illness. Adjustment involves coping with multiple tasks of illness that involve coping with a changed self, changes in interpersonal relationships and future uncertainty. It is best conceptualized as a dynamic process that involves the interplay between persons and their environments. There is a good deal of heterogeneity in adjustment patterns, with most reporting generally positive adjustment and the minority evidencing significant distress or life disruption. Above all, there is not one way to successfully adjust to chronic illness; evaluation of adjustment must take the individual's life context into account.

—Tracey A. Revenson and  
Annette L. Stanton

See also ARTHRITIS: BEHAVIORAL TREATMENT; ARTHRITIS:

PSYCHOSOCIAL ASPECTS; ASTHMA: BEHAVIORAL TREATMENT; ASTHMA AND STRESS; CANCER: PSYCHOSOCIAL TREATMENT; CAREGIVER STRESS; CHRONIC DISEASE MANAGEMENT; CHRONIC OBSTRUCTIVE PULMONARY DISEASE: PSYCHOSOCIAL ASPECTS AND BEHAVIORAL TREATMENTS; CONTROL AND HEALTH; DIABETES: BEHAVIORAL TREATMENT; DIABETES: PSYCHOSOCIAL ASPECTS; EMOTIONS: NEGATIVE EMOTIONS AND HEALTH; EMOTIONS: POSITIVE EMOTIONS AND HEALTH; FIBROMYALGIA SYNDROME: BIOBEHAVIORAL ASPECTS; FIBROMYALGIA SYNDROME: COGNITIVE-BEHAVIORAL TREATMENT; HEADACHES: PSYCHOLOGICAL MANAGEMENT; IRRITABLE BOWEL SYNDROME: PSYCHOLOGICAL TREATMENT; IRRITABLE BOWEL SYNDROME: PSYCHOSOCIAL ASPECTS; OPTIMISM, PESSIMISM, AND HEALTH; QUALITY OF LIFE:

MEASUREMENT; RAYNAUD'S DISEASE: BEHAVIORAL TREATMENT; SELF-EFFICACY; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; SOCIOECONOMIC STATUS AND HEALTH; STRESS, APPRAISAL, AND COPING; STRESS-BUFFERING HYPOTHESIS; STRESS-RELATED GROWTH; SUPPORT GROUPS AND HEALTH

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## CHRONIC OBSTRUCTIVE PULMONARY DISEASE: PSYCHOSOCIAL ASPECTS AND BEHAVIORAL TREATMENTS

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Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in the United States,

with annual health care costs of approximately \$27 billion. Patients with COPD frequently have concomitant symptoms of psychological distress, especially depression and anxiety, and may exhibit deficits in cognitive functioning, as demonstrated on standard neuropsychological tests. In addition, patients with COPD often experience reduced quality of life, reflected by impaired social relationships, diminished work performance, and reduced capacity for performing activities of daily living (ADL). Psychosocial aspects of COPD also may include smoking cessation, maintenance of nutritional balance, and medication compliance.

Medical treatment of COPD includes medications, surgery, and physical exercise. Patients with COPD are routinely treated with multiple medications, such as bronchodilators, inhaled steroids, oral steroids, and oxygen. Surgical treatments, including lung volume reduction surgery and lung transplant surgery, are also options for selected patients. However, the standard of care for patients with COPD now includes exercise rehabilitation; studies have documented multiple positive outcomes of exercise among patients with COPD. Rehabilitation programs often incorporate individual and group treatment sessions designed to address specifically the behavioral and psychological aspects of coping with COPD. This entry elaborates on the psychosocial components of COPD and the strategies for treating psychosocial problems among patients with COPD.

## WHAT IS COPD?

The COPD diagnosis may encompass any of three diseases—chronic bronchitis, emphysema, and asthma—all of which are characterized by expiratory airflow obstruction. Although these three diseases differ somewhat with regard to etiology and degree of related disability, the clinical symptoms frequently overlap, and often COPD patients are diagnosed with more than one of the three diseases. Asthma alone, however, would not be categorized as COPD because patients with COPD, unlike asthmatics, do not revert back to normal pulmonary functioning between episodes of breathing difficulty and they tend to be refractory to the drugs that relieve bronchospasm in most asthmatic patients.

Although many of the changes in lung function of patients with COPD (e.g., decreased lung capacity) resemble those of normal aging, the changes occur at

an accelerated rate for COPD patients. In addition, changes such as airway obstruction and pulmonary blood flow irregularities are markers of lung pathology that do not occur with normal aging. These latter changes eventually lead to decreased oxygen uptake in the bloodstream and, ultimately, a state of chronic hypoxia. The chronic hypoxia of COPD patients has been associated with physical limitations such as fatigue and deconditioning. Most patients with COPD become severely deconditioned and lose muscle mass due to reduced activity level.

## DEMOGRAPHIC/SYMPTOM

### PROFILE OF THE PATIENT WITH COPD

The typical patient with COPD is over age 60, with shortness of breath (dyspnea) during physical activity and chronic coughing. The primary risk factor for COPD is cigarette smoking, and most patients with COPD have an extensive history of smoking. However, COPD also may be diagnosed in nonsmokers due to a genetically inherited form of the disease (alpha-1 antitrypsin deficiency). Other risk factors for COPD include age and exposure to environmental contaminants (e.g., air pollution, workplace exposures). Although COPD has affected predominantly men in the past, the incidence among women has increased significantly in recent years, largely because the cigarette-smoking habits of women have become more similar to those of men.

Early in the course of COPD, dyspnea occurs only with physical activity, but as the disease progresses, dyspnea may be exacerbated by changes in weather, respiratory infections, and the exertion required for relatively mild ADLs such as dressing and showering. Dyspnea also may occur at times of emotional distress, such as when the patient is feeling anxious or extremely angry. Coughing may contribute to difficulty in breathing, and excessive coughing in public may be associated with social embarrassment. Because the onset and early progression of COPD is insidious, with symptoms usually worsening only gradually, patients may ignore symptoms until the disease becomes unmanageable or requires hospitalization.

## Psychosocial Functioning

Psychological distress associated with pulmonary disease may influence functional status and physical well-being, independent of disease severity. Recent

studies have documented that psychological factors are more strongly associated with mortality than medical factors such as disease severity and blood oxygenation levels. Thus, assessment and treatment of psychological factors are critical for effective treatment of the patient with pulmonary disease. Common psychological reactions among patients with pulmonary disease include anger, frustration, guilt, dependency, and embarrassment. However, depression and anxiety are the most frequently observed psychological reactions among patients with COPD.

### *Depression*

Depression in patients with COPD typically is characterized by hopelessness, a pessimistic outlook, reduced sleep, decreased appetite, increased lethargy, concentration difficulty, and increased social withdrawal. Depression in COPD patients may significantly limit daily functioning. Studies consistently report that depressed mood predicts behavioral, social, and mental functioning, and greater depressive symptoms have been associated with higher levels of impairment in ADLs. Although the correlation between depressed mood and disease severity is modest, depression may have an influence on daily functioning that is independent of pulmonary functioning and disease severity.

### *Anxiety*

Symptoms of anxiety are manifested in various ways, including accelerated speech, exaggerated body movements, and physiological signs of arousal such as tachycardia, sweating, and dyspnea. Most patients with COPD report symptoms of anxiety, and up to 37% of patients may experience one or more panic attacks. Dyspnea itself, in conjunction with a fear of suffocation and death, is a source of significant anxiety in this population. The emotional arousal of anxiety increases ventilatory demands on the body that may lead to hypoxia or hypercapnia. Increased physiological arousal, in turn, exacerbates anxiety symptoms, which then produce greater physiological insufficiency, resulting in a self-perpetuating cycle of dyspnea and panic.

### **Cognitive Functioning**

Studies have documented mild impairment in neuropsychological functioning among patients with

COPD. Impairments have been observed in problem solving, psychomotor speed, attention, and verbal memory, but verbal intelligence does not appear to be affected. Studies suggest that there is a modest correlation between neuropsychological impairment and hypoxemia, but that neuropsychological functioning is not associated with standard indicators of pulmonary function.

### **Social Functioning**

The physical limitations of COPD may have profound effects on family relations and lifestyle, including diminished wage-earning ability, changes in family roles, reduced independence, reduced social activities, and impaired sexual functioning. Perceived social support and satisfaction with social resources have been found to influence functional status both directly and indirectly (via negative mood and somatic symptoms).

### **Behavioral Functioning**

Patients with COPD are typically confronted with difficulties in numerous areas of life functioning and may report significant impairments in bathing, grooming, dressing, eating, sleeping, and mobility. In addition to difficulties in ambulation and home management, COPD often limits recreational activities. No direct relationship between pulmonary function and functional status has been observed, but pulmonary function may indirectly affect functional status via its effect on exercise capacity. In general, pulmonary function appears to be no more important in predicting functional capacity than other more subjective factors, including indicators of psychological well-being.

### *Medication Compliance*

The medical regimen of individuals with COPD is often complex, with an average of 6.3 medications per patient. Consequently, nonadherence is high, with about half of patients overutilizing or underutilizing their medications. Unfortunately, little is known about the factors associated with noncompliance in patients with COPD or about ways in which compliance can be increased in this population. The most common reasons for noncompliance among patients with COPD are forgetfulness and refusal to take medications,

both of which are thought to result from patients feeling well enough without medication. Other factors frequently associated with noncompliance are medication side effects, changes in daily routines, running out of medication, and impaired long-term memory.

### *Treatment Strategies*

Because of the independent influence of emotional and behavioral factors on daily functioning, treatments designed to increase physical health and quality of life among patients with COPD must focus on reducing emotional distress and modifying maladaptive behavior patterns. Psychological distress may be treated by means of group counseling, psychotherapy, medication, exercise rehabilitation, or a combination of several modalities. Psychological treatments targeting catastrophic misinterpretations of bodily symptoms are thought to decrease experiences of panic in COPD patients. Relaxation training also may reduce symptoms of anxiety, dyspnea, and airway tightness in COPD patients.

One prototype for treatment of pulmonary patients is the cognitive-behavioral format in which patients are taught relaxation skills, combined with cognitive restructuring and identification of emotional changes. This approach, in either a group or individual format, provides patients a model for coping with situations that trigger psychological distress and physical symptoms. Activity planning and pacing are essential in the treatment of patients with COPD, and may be included in cognitive-behavioral interventions. Patients are encouraged to schedule daily activities, list them on a daily planner, and mark them off as they are completed. This approach has been shown to contribute to significant increases in walking activity among patients with COPD and to facilitate compliance with medical care recommendations (e.g., medications, exercise). Scheduling pleasurable activities is encouraged to facilitate the patient's sense of control and to prevent depressive symptoms. Patients also learn to adapt to the slower pace at which they complete physical activities and to identify enjoyable aspects of their daily activities. Although cognitive-behavioral treatments usually occur in four or more sessions over the course of several weeks, recent data have demonstrated the efficacy of a brief (2-hour) group session of cognitive-behavioral treatment for reducing depression and anxiety among patients with COPD.

Due to the importance of social support for health and psychological well-being of patients with pulmonary disease, pulmonary rehabilitation programs provide an ideal way for patients to meet with their peers, to learn about their illness, and to learn strategies for minimizing their symptoms and increasing their physical endurance. Rehabilitation programs may include spouses/caregivers in the educational components of the program to facilitate adherence to medical care recommendations after the rehabilitation program has been completed and to provide a forum for discussion of changing roles/responsibilities in the home environment.

### *Smoking Cessation*

For most patients, symptoms of COPD or a recent diagnosis with COPD are sufficient to motivate smoking cessation. However, for patients who continue to smoke, behavioral research suggests that comprehensive treatments targeting psychological functioning may increase the efficacy of smoking cessation, and that a multicomponent treatment program may be more effective than treatment in a single modality. In addition, psychological variables seem to play a role in both the ability to quit smoking and the likelihood of relapse. Self-efficacy expectations are the strongest predictor of smoking cessation among patients with COPD, and depressed mood has been associated with reduced ability to quit smoking. Thus, smoking cessation interventions in this population are most likely to succeed by targeting self-efficacy expectations and depressed mood.

### *Nutritional Status*

Studies indicate that a significant number of patients with COPD are malnourished, as indicated by lower than normal body weight, tricep muscle skin folds, arm muscle circumference, and caloric intake. Recent behavioral research has indicated that malnourishment may be associated with impaired psychological well-being and that dietary supplements may reverse deterioration in both psychological and physical functioning associated with depleted nutrition.

### *Physical Exercise*

Exercise among patients with COPD generally is associated with reductions in depression and anxiety,



increased positive affect, and increased self-efficacy for walking. Exercise also has been associated with enhanced quality of life and with improvement in aspects of cognitive functioning (e.g., verbal fluency, psychomotor performance). Exercise compliance is at the heart of all rehabilitation programs, and continued compliance (adherence) is essential for patients to maintain gains following the program. The relapse prevention strategy appears to be useful for patients with COPD in that it teaches patients to prepare for and respond to bouts of illness, during which they may be temporarily reluctant or unable to exercise. In addition, because negative mood states may be associated with reduced energy and diminished interest in activities such as exercise, strategies for improving mood also, in turn, are likely to contribute to better exercise performance. Ongoing studies have evaluated procedures to encourage individual, in-home exercise behavior, and recent data suggest the effectiveness of strategies such as distractive auditory stimuli (e.g., music) for enhancing exercise performance among patients with COPD.

## SUMMARY

Psychosocial effects of COPD include psychological distress, cognitive impairment, and reduced ADLs. Exercise training has a positive effect on all three areas of functioning. In addition, cognitive-behavioral strategies have proven useful in treating patients with significant mood disturbance and other behaviorally based problems, including continued cigarette smoking, poor eating habits, and noncompliance with exercise or other medical recommendations.

—Charles F. Emery

See also ADHERENCE TO TREATMENT REGIMENS; ARTHRITIS:

BEHAVIORAL TREATMENT; ARTHRITIS: PSYCHOSOCIAL ASPECTS; ASTHMA: BEHAVIORAL TREATMENT; ASTHMA AND STRESS; CHRONIC DISEASE MANAGEMENT; CHRONIC ILLNESS: PSYCHOLOGICAL ASPECTS; COGNITIVE FUNCTION AND HEALTH; DIABETES: BEHAVIORAL TREATMENT; DIABETES: PSYCHOSOCIAL ASPECTS; FIBROMYALGIA SYNDROME: BIOBEHAVIORAL ASPECTS; FIBROMYALGIA SYNDROME: COGNITIVE-BEHAVIORAL TREATMENT; HEADACHES: PSYCHOLOGICAL MANAGEMENT; IRRITABLE BOWEL SYNDROME: PSYCHOLOGICAL TREATMENT; IRRITABLE BOWEL SYNDROME: PSYCHOSOCIAL ASPECTS; RAYNAUD'S DISEASE: BEHAVIORAL TREATMENT; SMOKING AND NICOTINE DEPENDENCE: INTERVENTIONS

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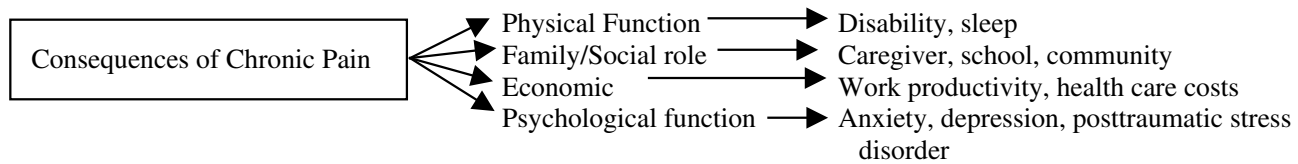
# CHRONIC PAIN MANAGEMENT

Medical advances and interventions have yielded significant gains in life expectancy, but the increasing prevalence of pain complaints threatens to impair quality of life. Appropriate pain assessment and management present significant challenges for patients, health care providers, health care organizations, insurance providers, and health care policymakers. This entry provides an overview on chronic pain assessment and management.

## INTRODUCTION

Pain involves damage to the body (e.g., twisting an ankle, burning a finger), communication that there is an injury from the site of the injury to the spinal cord (i.e., transmission), and last, communicating this information from the spinal cord to the brain where pain is perceived (i.e., perception). In addition, there is often an emotional response to pain. Pain is defined as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage." This definition involves perception of a painful stimulus and reaction to the sensation, which includes a level of subjectivity to the pain experience. Thus, it follows that pain significantly affects overall health (i.e., a state of complete physical, mental, and social well-being). This definition for pain entails a broader concept than that typically employed in biomedical research and clinical medicine, transcending both physical disease and emotional distress.

In general, pain is described by a simple relationship to an inciting event or injury, which is generally protective and self-limited, especially in the acute (early) injury phase. Although most often a protective



**Figure 1** Consequences of Chronic Pain

phenomenon, pain can be detrimental, increasing morbidity (i.e., increasing heart rate and blood pressure, causing fear and anxiety). There is considerable overlap in the types of pain, although it is most often classified by duration or etiology as (1) acute (i.e., pain of less than 6 months duration), (2) chronic (aka, chronic nonmalignant pain, chronic benign pain; i.e., pain of greater than 6 months duration), or (3) cancer pain (i.e., pain that is attributed to cancer or is the sequelae of cancer treatment).

### IMPACT OF PAIN

Chronic pain is estimated to be the third largest health problem in the world. It is also a national health problem with significant implications on health and wellness. The increasing prevalence of chronic pain has significant and potentially devastating socioeconomic and health ramifications. For instance, pain affects more than 75 million Americans. More specifically, back pain is estimated to be the leading cause of chronic pain and the second leading cause of all physician visits. Pain leads to more than 700 million lost workdays and greater than \$60 billion in health care expenditures annually. Americans spend an additional \$40 billion a year on chronic pain. Chronic pain is the most frequent cause of disability in the United States.

Chronic pain affects many facets of an individual's life. Beyond the physical manifestations, there are significant suffering and psychological manifestations due to chronic pain. When compared to the general population, patients with pain have an increased psychological burden, as demonstrated by the high prevalence of posttraumatic stress disorder (PTSD), sleep disturbance, anxiety, and depressive symptoms, which independently increase morbidity and mortality. Pain does not occur in isolation and has a significant impact on the caregiver. In many chronic medical conditions, social health support systems diminish. Thus, lower social supports from caregivers and family members of

people living with chronic pain are important factors that may have an additive effect in increasing an individual's risk for psychological distress and suffering due to pain. The potential ways that chronic pain affects an individual's health are shown in Figure 1, which illustrates how pain impairs physical, psychological, social, and economic functioning.

Despite the significant toll of chronic pain, there are no universal guidelines for chronic pain management. The U.S. Agency for Health Care Policy and Research (AHCPR) sponsored the development of guidelines for the treatment of acute postoperative and cancer pain as well as for chronic low back pain. Yet 70% of cancer patients die with uncontrolled pain, and nearly 40% of postoperative patients experience significant pain. This has profound effects on outcome (e.g., increased morbidity and mortality), quality of life, and health care expenditures. Clearly, as Americans live longer, the prevalence of pain will increase, impairing quality of life as well as health and well-being. Yet all types of pain remain relatively undertreated, and the adequate assessment and appropriate management of chronic pain remain a neglected part of medicine. To complicate things further, most physicians have received minimal pain education, although there are many different modalities available to treat patients with pain.

### DIFFERENCES IN CLINICAL PAIN

The effects of pain vary substantially. For example, two patients with the same level of disease activity can differ greatly in terms of the amount of pain that they report and its impact on their lives. Little is known about how gender, aging, and ethnicity influence the effective provision of pain management. Biological, physiological, and sociological mechanisms have been proposed to explain the differences in the pain experience. These mechanisms include differences in the reproductive organs, sex hormones, central nervous system, pain-learning methods,

culturally imposed factors, and social roles that predispose certain individuals toward increased responsiveness to a painful stimulus. How these differences apply to the individual with pain remains unknown.

The literature indicates definite gender differences in the prevalence of many chronic pain conditions. Although prevalence patterns may vary by stage in the life cycle, women have a higher overall prevalence for most chronic pain conditions. Certain clinical pain conditions (e.g., fibromyalgia, temporomandibular joint disease, tension-type headache) that are unrelated to the gynecologic organs are much more prevalent in women. These chronic pain syndromes are often characterized by increased experimental pain sensitivity and enhanced vulnerability to experimental pain, suggesting gender-based differences in pain modulation. Gender-based differences in pain symptoms for both acutely and chronically painful conditions as well as response to opioid analgesics have been reported. The clinical implications of these unique gender-related findings for pain management in a chronic pain population are unclear.

## MANIFESTATIONS OF PAIN

Differences in the ability to cope with pain have been identified. Availability and satisfaction with social support are important factors to consider in adaptation to any chronic illness such as chronic pain. An abuse history has been shown to affect chronic pain symptoms and coping. For instance, chronic physical or sexual abuse history (i.e., sexual or physical abuse that occurred during both adulthood and childhood) might be an important predictor for the development and maintenance of chronic pain states in women. In addition, patient attitudinal differences in regard to pain may influence the chronic pain experience. Limited awareness of the impact of chronic pain and the scarcity of outcome studies may increase the likelihood of the undertreatment of pain.

Variability in treatment based on gender can lead to differences in outcome. The literature suggests that physicians handle the pain complaints of women, racial and ethnic minorities, and the elderly less aggressively. The gender of the physician has also been shown to contribute to variability in the treatment women receive for pain. Differences in the way women communicate their pain concerns may increase the likelihood of their complaints being attributed to a mental health disorder.

Disturbing differences exist in the treatment of pain based on the patient's age, race, and gender, with women and ethnic minorities receiving lesser-quality care. However, little is known about how patient demographic and cultural factors influence pain treatment-seeking behavior and treatment. Considerable physician variability in the treatment of pain has been demonstrated, revealing lesser goals for chronic pain relief, less satisfaction in the management of chronic pain, lesser treatment for women with pain, and decreased ability to manage chronic pain versus other types of pain. Physician variability and suboptimal treatment strategies for chronic pain may lead to increased suffering while adversely affecting an individual's overall health.

To address the inadequate treatment of pain, many specialty organizations have developed guidelines for pain assessment and management. In addition, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) developed pain requirements for all accredited organizations. The requirements are as follows:

1. Recognize the rights of patients to appropriate assessment and management of pain.
2. Assess the existence of and the nature and intensity in all patients.
3. Record the results of the pain assessment in a way that facilitates regular assessment and follow-up.
4. Determine and ensure staff competency in pain assessment and management in the orientation of all new staff.
5. Establish policies and procedures that support the appropriate prescription or ordering of effective medications.
6. Educate patients and their families about effective pain management.
7. Address patient needs for symptom management in the discharge processes.

## PAIN ASSESSMENT

Pain is a subjective personal experience with no objective measures. Models used to determine pain perception in the experimental research setting do not transfer well to the clinical arena. Thus, pain perception is subjective and personal. Each patient reacts to

a painful stimulus and the pain experience differently. Initial pain assessment requires a thorough history and physical exam.

The gold standard for pain assessment remains patient self-report. On initial assessment, health care providers should assess the patient for pain. Most commonly, the assessment of pain entails asking the patient to quantify his or her pain via a 10-point visual, numerical, or verbal analog pain scale (0 = *no pain*; 10 = *worst pain*). Another important component in quantifying pain involves assessing how comfortable and how satisfied patients are with their level of pain. A patient with a pain score of 7 (typically consistent with severe pain) may be completely comfortable and satisfied with his or her pain regimen while another patient may report a pain score of 3 (typically consistent with mild pain) and be uncomfortable as well as unsatisfied with the pain control. It is important to note that quantitative pain estimates from surrogates should not be used unless the patient is unable to report.

Other scales can be helpful in assessing pain depending on the patient's vision, cognition, and development. Both geriatric and pediatric patients as well as persons who are cognitively or visually impaired, non-English speaking, and racial and ethnic minorities may have trouble with using traditional methods to assess their pain. These communication challenges put certain populations at risk for the undertreatment of pain. Different scales have been developed and are available to address those with special needs and disabilities. For instance, elderly people may prefer to use word descriptors (e.g., "none," "mild," "moderate," "severe," "extreme") to quantify their pain, while children may prefer visual cues (e.g., faces). Of particular importance is that elderly people often minimize the impact of pain on their lives and may not use the word *pain*. Furthermore, they may view pain as a normal part of aging that they must learn to live with. Children may not be able to quantify their level of pain due to their level of development and may prefer to choose faces or to use colors to describe their pain. In addition, parental assessment of the child's behavior may be necessary.

A physician should assess persistent pain that significantly affects function or quality of life. Information regarding pain characteristics (e.g., burning, aching, soreness) is sought. Reports from family members and caregivers are often helpful in assessing pain. The comprehensive assessment of pain as done

in pain centers often involves a pain diagram and an evaluation of psychosocial function. This often includes the completion of lengthy surveys (e.g., McGill Pain Questionnaire, West Haven Yale Multidimensional Pain Inventory) and pain diagrams. Mood assessment, especially depression (e.g., Beck Depression Inventory), as well as sleep disturbance, disability (Pain Disability Index), and social support relationships, are also done. Evaluations of physical functioning and limitations are also part of the exam.

Considerable misinformation regarding pain management exists. Physicians have received minimal education regarding pain and do not routinely ask about the presence of pain, yet it is one of the most common reasons that a patient consults a physician. Regulatory policies surrounding opioid analgesics may limit their prescriptions for pain management. Furthermore, insurance issues may also limit access to certain types of pain treatment. It is critically important for patients and their physicians to become partners in developing a treatment plan designed to improve the patient's quality of life. Thus, as partners in their own pain care, it is important that patients present their pain complaints to their physicians. It is extremely important and helpful if patients bring a notebook to the doctor appointments with questions and concerns regarding their pain.

#### **Recommendations for Patients With Persistent Pain: How to Discuss Pain Complaints With Health Care Providers**

1. Know your pain rights. Make certain that your health care provider is aware of your pain.
2. Describe the circumstances or events that led to the pain as well as the duration of pain.
3. Describe where the pain is located as well as its character, frequency (or pattern), and location.
4. Describe if the character or quality of your pain has changed.
5. Describe how bad the pain is (e.g., 0 = *no pain*, 10 = *worst pain imaginable*) today, on a good day and on a bad day.
6. Describe any precipitating and relieving factors (i.e., what makes it worse and what makes it better).
7. Describe any associated symptoms.
8. Describe how the pain has affected your life (i.e., sleep disturbance, weight gain or loss, eating changes, depressive symptoms, marital discord, alcohol and cigarette use).

9. Discuss any previous pain problems and any family history of pain problems.
10. Discuss current and previously used therapeutic modalities including prescription and nonprescription analgesics, over-the-counter medications, and nonpharmacological approaches. Note the effectiveness and side effects of each therapeutic modality.
11. Keep a pain journal or log with regular entries that include time the pain occurred, pain intensity and severity, medication(s) used, and how your pain responded.

After initial assessment (including physical exam) and determining the cause of pain, both the patient's and the physician's goals for pain relief should be established and agreed on. A treatment plan should be developed, since inadequately treated pain can lead to significant health problems (e.g., sleep problems, depression, anxiety, social isolation, health care utilization) while exacerbating other medical problems.

## TREATMENT FOR PAIN

### Therapeutic Modalities

The initial treatment plan involves obtaining a complete history and physical examination, review of laboratory and other tests, and documentation of pain. Since pain involves perception, transmission, and the initial injury, therapeutic agents work at many different levels.

### Education

Education is an important step in treating pain. As a first step, information on the impact of pain on the individual, family, and society should be provided or obtained, since many things affect pain. In addition, education about different therapeutic modalities should be provided for patients, caregivers, and family members; health care providers; and health care policymakers.

### Nonopioid Analgesics

*Acetaminophen* is a first-line drug and the drug of choice in relieving mild to moderate pain, especially musculoskeletal and arthritis pain. It is often used as a combination product with other analgesics. Since

toxic levels can occur, doses should be limited to less than 4,000 mg/day in adults or less than the 3,000 mg/day in the elderly. It does not inhibit wound healing and can only be administered orally or via the rectum.

*Nonsteroidal anti-inflammatory drugs (NSAIDs)* are commonly used to provide analgesia. NSAIDs work at multiple places, including the brain, to provide analgesia. They primarily inhibit prostaglandins, which are produced by COX-1 and COX-2 enzymes by inflamed tissues in response to pain. Although NSAIDs are very effective analgesics, they have significant side effects and are the most common cause of adverse drug reactions (e.g., gastrointestinal bleeding, nausea, kidney problems), especially in the elderly. The traditional NSAIDs, which inhibit the COX-1 enzyme (e.g., ibuprofen, naproxen), may cause more gastrointestinal injury than the newer agents, which specifically inhibit the COX-2 enzyme (e.g., rofecoxib, celecoxib). When used with opioid analgesics, they can decrease the opioid analgesic requirements. However, NSAIDs should be stopped several days prior to surgery.

*Aspirin* is a common anti-inflammatory agent. However, it is of limited use in the chronic pain setting due to its many undesirable side effects (e.g., bleeding, bruising). Aspirin should be stopped prior to surgery.

### Opioid Analgesics

Opioid analgesics (aka, narcotic analgesics) are the most common modality used for acute postoperative pain and are primarily used for moderate to severe pain problems in carefully selected patients with chronic pain. They are powerful analgesics (pain relievers), which primarily work in the spinal cord, brain stem, brain, and peripheral tissues to prevent the release of substances that cause pain. The opioid analgesics (e.g., morphine, hydromorphone, codeine, oxycodone, hydrocodone, methadone, and fentanyl) most commonly used provide significant analgesia via many different routes (i.e., oral, spinal, nasal, intravenous). However, opioids are often associated with undesirable side effects (e.g., constipation, respiratory depression, sedation, dependence, nausea, and vomiting). When prescribed, it is not unusual for the patient and physician to sign a contract describing conditions for their use, since they are often regulated.

## Adjuvants

### *Antidepressants*

The classical and most studied antidepressants, the tricyclic antidepressants (e.g., amitriptyline, nortriptyline, desipramine, and venlafaxine), have proven efficacy but also have more side effects than selective serotonin reuptake inhibitors (e.g., fluoxetine, sertraline, paroxetine) alone and in conjunction with other therapeutic modalities. Antidepressants have proven efficacy in the management of chronic pain (e.g., central poststroke pain, migraine and tension headache), especially neuropathic (nerve) pain (e.g., diabetic neuropathy, postherpetic neuralgia), and may decrease sleep disturbance. Chronic pain relief may occur without an antidepressant response, since their analgesic action is not mediated by the agent's antidepressant activity. In fact, antidepressants bind weakly at the same site as opioids do. The analgesic activity is more rapid (3-7 days) than when used for their antidepressant activity (14-21 days). They primarily work to improve sleep and pain by increasing the levels of certain hormones in the spinal cord, brain stem, and thalamus (e.g., dopamine, norepinephrine, and serotonin) acutely and chronically by regulating receptors and the activity of these hormones.

### *Other Adjuvants*

Other adjuvant therapies have proven themselves to be extremely useful for pain problems. Antiepileptic medications (e.g., gabapentin, valproic acid) are commonly used to treat painful neuropathies (e.g., radicular back pain, trigeminal neuralgia). In addition, commercially available local anesthetics impregnated in gauze (e.g., 5% lidocaine) and oral local anesthetics (e.g., mexilitene) have been useful in treating postherpetic neuralgia. Medications used to treat spasm often assist in treating pain (e.g., tizanidine, baclofen).

## Complementary and Alternative Techniques

Simple comfort measures (e.g., ice, heat, massage, prayer, reassurance) have been used for generations to enhance analgesics and should be used as potential modalities to control all types of pain. Complementary and alternative techniques (e.g., distraction methods, exercise, relaxation techniques, and music therapy) are very popular and are being increasingly researched. For instance, acupuncture and acupressure

have been used to decrease pain as well as the common side effects of traditional analgesics. Herbal medications (e.g., glucosamine chondroitin) are also beneficial in treating arthritic conditions. Nonpharmacological approaches (e.g., transcutaneous electrical nerve stimulation; TENS), used alone or in combination with appropriate pharmacological techniques, can be beneficial.

Chronic pain support groups are helpful as a mechanism for patients to improve their pain control. They allow patients to share their pain experiences while taking an active role in their recovery.

## Nerve Blocks

Therapeutic nerve blocks (e.g., epidurals) are often used to provide anesthesia (using local anesthetics) for surgical procedures. Pain management specialists use nerve blocks in selected patients. They are most often used when the pain follows an anatomic distribution or when anesthetic techniques can be used. These highly specialized therapies are particularly helpful for cancer pain syndromes and disorders involving the sympathetic nervous system (e.g., acute herpes zoster, reflex sympathetic dystrophy). Nerve blocks are most successful when used in conjunction with other therapeutic modalities.

## Manual Therapy

Physical therapy provides significant benefit for musculoskeletal problems to reduce pain and improve function. In addition, patients may benefit from aqua therapy to reduce stress in painful joints. Physical therapists with expertise in treating patients with chronic pain are desirable. Patients benefit the most when they are actively engaged in their care by participating in a structured program, both at an outpatient facility and in their home.

## Psychological Counseling

Patients often have a psychological reaction and experience poor coping due to chronic pain. In general, maladaptive coping (e.g., *catastrophizing*, repression) and poor adjustment (e.g., poor information seeking, passivity) appear to be important contributors to diminished health. Cognitive and insight-oriented psychotherapy is often warranted and provides significant benefits. Those patients who are

addicted to or abusing any legal (e.g., alcohol, cigarettes) or illicit substances should be referred to experts in pain, addiction, and psychiatry. The major reason pain does not get better is the failure to realize that psychological component. By recognizing the impact of emotions, people living with chronic pain can reduce stress, enhance coping, and decrease the impact of pain.

Repeat assessments with the same tools used during the initial pain assessment should be done. Included in these repeat assessments is a review of goals as well as medications and side effects due to therapies.

## REFERRAL

When, despite efforts to treat pain, the patient's or the physician's pain relief goals have not been met, referral to a multidisciplinary pain center for evaluation and treatment should be considered. The most successful treatment usually involves multiple approaches directed at treating the different components of pain via multiple modalities. Seemingly small changes in combination with multiple therapeutic modalities can often lead to significant improvement in a patient's pain and quality of life. The following provides information on how treatment modalities might progress:

1. Nonopioid  $\pm$  adjuvant
2. Opioid for mild to moderate pain + nonopioid  $\pm$  adjuvant
3. Opioid for mild to severe pain  $\pm$  adjuvant

Although chronic pain causes significant disability, an understanding of the treatment modalities available leads to healthier lifestyles, improved quality of life, and enhanced outcomes.

—Carmen Renée Green and Monica  
McPhail-Pruitt

See also CHRONIC DISEASE MANAGEMENT; PAIN;

## PSYCHOSOCIAL ASPECTS

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## CHURCH-BASED INTERVENTIONS

Throughout history, physical health has been a common component of the philosophy and the activities of religious organizations (ROs). However, as modern medicine emerged and intensive training and technology became the norm for the provider, medicine assumed more responsibility for physical health and ROs concentrated more on spiritual health. ROs did not ignore physical health, but their primary emphasis was on helping people with diseases to cope, rather than on disease prevention. As medicine continued to become more of a profession, the emphasis in ROs expanded to employing providers (e.g., parish nurses) or utilizing the RO facility as a clinic for medical care delivery.

As public health shifted from a focus on behaviors related to infectious diseases (e.g., sanitation, immunizations) to a broader view of health-related lifestyle factors and prevention of chronic diseases, funding agencies such as the National Institutes of Health began to include more funding for behavior change programs. Medical researchers began to partner more with behavioral scientists. In the mid- to late twentieth century, behavioral medicine researchers began to look to partner with various community organizations (e.g., work sites, schools) for program delivery as they searched for wider impact and recognized that many of these lifestyle behaviors are developed and maintained in the community. While ROs were included as partners in health care delivery, the programs implemented were rarely empirically evaluated and program development was not usually driven by behavior theory. This was due largely to the fact that most larger scale behavioral medicine research was federally funded. Fear of crossing the line of separation of church and state was a deterrent to both applying for and/or dispensing federal research funds for partnerships with ROs. Even private foundations shared this hesitancy. This resistance began to break down in the

1970s and 1980s with an accelerating interest in funding and in conducting such efforts. Thus, studies in ROs that include theory-driven behavior change interventions evaluated by sophisticated research designs are a relatively new phenomenon.

There are many advantages (and some disadvantages) for researchers, ROs leaders, and congregations to become involved in research partnerships for studying behavior change interventions. For researchers interested in large-scale public health programming, ROs provide a channel with enormous reach. The 2002 edition of the *Yearbook of American and Canadian Churches* reports over 152 million members of those ROs in the United States that report figures. Since nonmembers often attend health events at ROs, a large majority of U.S. citizens are reachable through programming in partnership with ROs. In addition, RO facilities are everywhere. Along with fire stations and schools, ROs are generally permitted in all neighborhoods regardless of zoning restrictions. In addition to availability, the designs of RO facilities are compatible with education. For example, classrooms are often an integral part of their design. Also, ROs are viewed as places where teaching and learning are expected, unlike other sectors such as retail and work sites.

Furthermore, ROs provide access to minority populations. This allows involvement of these participants (who are often hard for academic researchers to reach) in a safe and trusted environment. The RO is often the primary community organization, especially in African American neighborhoods, and are very influential in Hispanic neighborhoods as well. ROs also have relatively stable memberships with individuals who change residences often while still remaining members of the same RO. This is particularly important when the study is longitudinal and retention of participants for follow-up evaluations is critical. In addition, ROs are the only large-scale organization that includes the entire family over many years. Other critically important social networks also may be accessed through the RO. These networks can be utilized and built upon to help achieve and sustain behavior changes that affect others as well as the participant (e.g., changes in nutrition and physical activity, weight loss/control, smoking cessation). Volunteerism in ROs is the norm, with many aspects of the organization staffed by volunteers. Such volunteers bring more than inexpensive labor. They are members of the social networks of interest in lifestyle



change programs, thus providing ready access. Also, volunteers are already accepted by potential participants, understand the cultural context within which the changes are to take place, and speak the language of the participants. Furthermore, volunteers provide “coping models” as they make lifestyle changes themselves and remain as a resource long after funding for the research ends. They are also invaluable in recruitment and retention of formal research samples of participants. Finally, volunteers are more likely to be in a position to make appropriate environmental (physical and social) changes in the RO organization and facility (e.g., establishing health committees, healthier “church suppers,” no-smoking policies).

While there are many advantages for research partnerships, disadvantages must also be recognized. The academic research culture and that of ROs are quite different. For example, the RO culture tends to emphasize inclusiveness, but research designs often require withholding of the intervention to some for comparison purposes. Random assignment must also be thoroughly explained and justified to RO leaders and congregations. At least one investigator found that the pastors she worked with would not accept this traditional research design requirement. Another disadvantage revolves around the mandatory support of the RO leader, who can sometimes change during a study. RO leaders are very busy, so requiring much of their time will greatly reduce the number of ROs that will participate in the study. Thus, many researchers rely upon a key layperson or, in larger ROs, a “health” cleric as the primary liaison with the leading cleric. Another potential disadvantage for the researcher is the time required to establish meaningful partnerships and to sustain the relationships over time and across cleric changes.

Advantages for the RO leaders to be involved in research partnerships include the opportunity to provide their congregations with access to new health programs—this is especially true for ROs with large numbers of underserved members. The health programming also provides a venue for attracting new members. The disadvantages for the RO leaders include potential strain on the limited RO physical and financial resources, placing further demands on extremely busy clerics, and distraction of potential volunteers from other committees and activities more directly linked to the RO’s main mission. Some topics may also be in conflict with existing RO teachings (e.g., contraceptive use). Finally, the program being

provided by the research project may quickly disappear once research funding is over, leaving both the congregation and leadership feeling used and discarded.

This entry reviews behavior change research studies that have been conducted in ROs. Only studies including randomization, a longitudinal design, a comparison (or control) group, and evaluation of the physiological and/or behavior changes targeted by the intervention are included in this discussion. A number of other studies that did not involve random assignment and/or a comparison group indicate the versatility of ROs for behavior change research partnerships, and may be helpful references for the reader interested in feasibility issues. These studies have been conducted in a number of areas including cardiovascular health, weight loss, aerobic exercise, cholesterol control, nutrition change, fruit and vegetable increase, and cancer screening. The projects for inclusion in this discussion are also further restricted to those targeting specific and measurable outcomes rather than only process and feasibility variables such as acceptability and attendance. No attempt was made to include the broader topics of religion and health care delivery and the relationships between religion and mental and physical health. Other reviews can be found elsewhere.

The research studies that met our criteria, included in Table 1, are classified by level of involvement of the RO according to the definitions proposed by Lasater et al. Studies at Level I simply utilize ROs as sources of recruitment for a behavior change program. The Harlem Health Connection was a self-help smoking cessation project with recruitment for smoking cessation taking place in ROs, health care sites, and public housing projects. The self-help cessation program did not yield statistically significant effects compared to a no-treatment control. However, the church participants were the most likely to give a phone number and yielded the highest percentages of completed intervention phone calls compared to the health sites and public housing developments. Level II adds use of the RO facilities for delivery of at least some of the behavior change interventions being tested. The three studies reviewed for this level have reported positive results, but these are primarily attributable to the interventions themselves and not to the partnership with ROs, as only the RO facilities and target populations (congregation) are used.

Level III projects include members of treatment ROs as an important component of program delivery.

**Table 1** Representative Studies by Level of Partnership

<i>Level</i>	<i>Project Name</i>	<i>Topic</i>	<i>Ethnicity/Race<sup>a</sup></i>	<i>Target</i>	<i>Unit of Assignment</i>
I	Harlem Health Connection	Smoking Cessation	AA	Sample	133 Smokers
II <sup>b</sup>	Eat for Life	Fruit and Vegetable Consumption	AA	Sample	14 ROs
II <sup>b</sup>	Healthy Body/Healthy Spirit	Fruit and Vegetable Consumption	AA	Sample	16 ROs
II	Minimal Contact Education for Cholesterol Change	Cholesterol-Lowering Diet	H, NHW, AA	Sample	36 ROs
III	Campañeros el la Salud	Cancer Prevention and Control	H	Congregation	14 ROs
III	Go Girls	Weight Control for Adolescent Females	AA	Sample	10-14 middle and upper SES ROs
III	North Carolina Black Churches United for Better Health	Fruit and Vegetable Consumption	AA	Counties	50 ROs
III	PRAISE!	Cancer Nutrition	AA	Congregation	60 ROs
III	HARP	Cardiovascular risk factors	NHW	Congregation	25 ROs
III	LAMP	Mammograms	H, NHW, AA	Sample	45 ROs
IV	Project Joy	Cardiovascular risk profiles	AA	Sample	16 ROs
IV	Heart, Body and Soul	Smoking Cessation	AA	Sample	22 ROs
IV	LIGHT Way	Nutrition and Physical Activity	AA	Sample	26 ROs
IV	SisterTalk Hartford	Weight Control	AA	Sample	12 ROs
IV	Pacific Rim Cancer Screening Awareness Through Churches	Mammograms	H, NHW, AA, A	Sample	78 ROs

<sup>a</sup> H = Hispanic; NHW = Non-Hispanic White; AA = African American; A = Asian

<sup>b</sup> Intervention includes scriptural elements.

At this level, the partnership is able to add volunteers for many of the program logistics, including program delivery. It is also easier to ensure that more of the elements of the intervention are consistent with those of the target audience. This is particularly important when tailoring interventions for specific cultural groups. Resnicow et al. state that culturally sensitive interventions can be conceptualized by two primary dimensions: surface structure and deep structure. Surface structure involves matching intervention materials and messages (channels and settings, people,

places, language, music, food, brand names, locations, and clothing) to observable social and behavioral characteristics of a target population. Deep structure involves how populations differ in general (i.e., core cultural values), as well as how ethnic, cultural, social, environmental, and historical factors may influence specific health behaviors. Level III interventions are more able to be culturally tailored, as church members and volunteers are more involved in program design and delivery. In addition, at Level III, the results reported can more comfortably be attributed, at least

in part, to the partnership and not just the behavioral intervention alone. Only one of the six Level III studies has reported final results. Campbell et al. reported very impressive changes in fruit and vegetable intake.

Level IV adds spiritual/scriptural components to the interventions that include congregation members in the delivery of the program. Spirituality is a core cultural value for many populations groups, including African Americans and some Hispanic groups. Inclusion of spiritual/scriptural components allows for a better fit between program and participants (deep structure), can maximize motivation, and should increase the length of time the program is maintained after funding ends. At this level, the full benefits of the partnership can be realized. Intervention designers can incorporate elements from both behavioral theory/practice and the motivating and supportive underpinnings of the religious teaching. Five studies have been classified as Level IV. There have been several projects that included scriptural elements, but were not delivered by RO members. Thus, they remained classified as Level II.

Several Level IV studies have published study results. Project Joy has reported positive results for weight and some dietary intake variables. The other Johns Hopkins University study, Heart, Body and Soul, also reported positive impact on progress along stages of change in smoking behavior. The other studies at Level IV have not yet published final results, but early indications are very positive for feasibility and for the compatibility of faith-based teachings and behavior change theory and practice. With the exception of the Pacific Rim Cancer Screening Awareness through Churches study by Sarah Fox at the University of California, Los Angeles, all the Level IV studies to date have been (or are being) conducted primarily with African Americans. More Level IV studies with other ethnic groups are needed.

Thus, there have been a number of large, scientifically sound RO-based behavioral intervention studies funded in the past several decades, with the majority being funded in the past 10 years. It is feasible to conduct behavioral medicine research in partnership with ROs. Most of the lessons learned to date tend to be how to form and sustain the partnerships. In addition, those programs that have relied upon volunteers from within the RO as program implementers have found that such volunteers are available in sufficient numbers and can be trained to effectively deliver lifestyle behavior change programs in their own ROs.

Almost all of the current studies have been conducted with churches. Whether the establishment of

such research partnerships can be extended to other ROs such as synagogues and mosques remains to be determined, and should be studied. Although few final results are available in the literature, it is clear that positive behavior change can be achieved in RO-research partnerships. More research needs to be done before generalizable conclusions can be made about conducting behavior change research in ROs compared to other types of community organizations.

—Thomas M. Lasater and  
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## COGNITIVE FUNCTION AND HEALTH

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It is well known that neurological (brain) diseases such as Alzheimer's disease can have a devastating

impact on cognitive abilities, frequently causing serious disabling mental impairment known as dementia. Recently, we have learned that medical diseases involving physiological systems other than the brain, such as the cardiovascular (heart and blood vessels), pulmonary (lungs), and hepatic (liver) systems, can also negatively impact cognitive function by exerting a variety of direct and indirect effects on the brain. Furthermore, factors that influence the development of medical diseases, such as health habits and hormones, and treatments for disease can also affect the brain and cognitive function by both direct and indirect means. Overall, it seems that healthy people tend to have better cognitive function whereas unhealthy people tend to have poorer cognitive function.

What is cognitive function? It refers to one's ability to perceive, process, and respond to information and includes a variety of skills such as attention, learning and memory, the ability to organize and execute purposeful behavior (i.e., executive functions), spatial and perceptual abilities, speed of processing and responding to information, and language abilities. Having adequate cognitive function is an important aspect of people's quality of life. When individuals experience cognitive difficulties, it can diminish their sense of well-being and sometimes their ability to function in their everyday lives.

As people get older, they typically experience some decline in cognitive function. It is thought that at least a portion of this cognitive change that has previously been attributed to the aging process is actually due to medical diseases that are common in older adults. Important, though, is the finding that medical diseases (and other biological and lifestyle factors that promote illness) can negatively affect the brain and therefore cognitive function in people of any age, and may exert cumulative effects over time. Similarly, certain good health habits can help protect cognitive function at any age.

Examples of the types of factors related to health and illness that can affect cognitive function include lifestyle factors, hormones, genetics, medical diseases, exposure to toxic substances in the environment, and medical and surgical treatments for disease (see Waldstein, 2000). These factors typically do not disable the brain and associated cognitive abilities to the same extent as do the neurological diseases such as Alzheimer's disease. However, even the more mild to moderate effects of these factors on cognitive

function can impact people's lives and can predispose to more serious impairments further on down the road if the diseases are not treated properly.

Several lifestyle factors or health habits are known to affect cognitive function. For example, health-compromising behaviors such as smoking, heavy alcohol consumption, drugs of abuse (e.g., opiates, cocaine), and physical inactivity have been associated with poorer cognitive function. In addition, dietary insufficiencies, such as vitamin B<sub>6</sub>, vitamin B<sub>12</sub>, thiamine, folate, and zinc, have been related to cognitive difficulties, as has high caloric consumption. In contrast, health-enhancing behaviors have been associated with better cognitive functioning. For example, greater intake of antioxidants such as vitamin C and greater levels of physical fitness or physical activity have been associated with higher levels of cognitive function. In addition, cognitive function can improve with aerobic exercise training in both healthy people and people with chronic medical diseases. For example, Dr. Charles F. Emery and his colleagues at Ohio State University found that patients with chronic obstructive pulmonary disease who participated in a structured aerobic exercise group for 10 weeks showed improvements in cognitive function as compared to patients who did not (Emery, Schein, Hauck, & MacIntyre, 1998).

Next, various hormones have been associated with cognitive function. For instance, low levels of estrogen or testosterone have been related to poorer cognitive function, as have both high or low levels of several thyroid and pituitary hormones, high resting levels of cortisol (a stress hormone), and greater cortisol responses to stress. On the other hand, hormone replacement therapy has been associated with better cognitive function. Examining data from the Baltimore Longitudinal Study on Aging, Dr. Susan M. Resnick and her colleagues at the National Institute on Aging found that postmenopausal women receiving hormone therapy had better memory function than women who did not (Resnick & Maki, 2001).

Genetic factors can also affect cognitive performance. One such factor that has received much attention is the apolipoprotein E (APOE) gene. Although most commonly examined in relation to brain diseases that cause dementia (such as Alzheimer's disease), the presence of a certain variant of the APOE gene known as the E4 allele has also been associated with poorer

cognitive function in healthy people. In addition, Dr. Mary N. Haan and her colleagues at the University of Michigan found that having an APOE E4 allele was related to a greater rate of cognitive decline in people with vascular diseases or diabetes (Haan, Shemanski, Jagust, Manolio, & Kuller, 1999).

Environmental or occupational exposure to chemicals, such as solvents and lead, is toxic to the brain and has been associated with cognitive dysfunction. Both chronic low-level exposure and peak exposures, or a combination thereof, can be problematic. In that regard, Dr. Lisa A. Morrow and her colleagues at the University of Pittsburgh found that a group of journey-person painters with chronic solvent exposure performed most poorly on memory tests after having a recent acute exposure (Morrow, Steinhauer, Condray, & Hodgson, 1997).

Numerous medical diseases have been associated with poorer cognitive function (see Tarter, Butters, & Beers, 2001). Examples include cardiovascular diseases such as hypertension and myocardial infarction (MI) (heart attack), pulmonary diseases such as chronic obstructive pulmonary disease and asthma, pancreatic diseases such as diabetes mellitus, hepatic diseases such as cirrhosis, autoimmune diseases such as systemic lupus erythematosus, various cancers, sleep disorders such as obstructive sleep apnea syndrome, and HIV and AIDS.

Cardiovascular disease presents a good example to discuss further. A negative impact of cardiovascular disease on the brain is indeed not surprising when one considers that the primary purpose of normal cardiovascular function is to supply blood that transports oxygen, glucose, and other essential nutrients to the cells of the body. Because the brain is relatively unable to store nutrients, it is highly dependent upon the cardiovascular system for a constant supply of blood and is quite vulnerable to interruptions of blood flow. Indeed, even a very brief cessation of blood supply to the brain can cause serious damage. Subtle reductions in cerebral blood flow that have been shown to occur in people with cardiovascular disease can therefore have negative short- and long-term consequences for the brain. Many research groups in the United States and Europe have found that a spectrum of cardiovascular diseases, including hypertension (high blood pressure), cardiac arrhythmias, coronary artery disease, MI (heart attack), and even peripheral vascular disease, are associated with poorer cognitive function (see Waldstein & Elias,

2001). Our research group at the University of Maryland, Baltimore County, University of Maryland School of Medicine, and Baltimore Veterans Affairs Medical Center has also found that increasingly severe manifestations of cardiovascular disease have incrementally greater negative impact on cognitive function (Waldstein et al., *in press*).

Many medical and surgical treatments for disease have been shown to affect cognitive performance. However, whereas some studies show improvements in cognitive function when a disease is treated, others show further decrements, and still others show no effect at all. This issue is complicated, because although medications and surgery can often help to manage a chronic medical disease, the underlying disease typically remains present. In addition, many medications can affect the brain by direct and indirect means, as can various surgeries. Examples of medical interventions that have been shown to have some positive effects on cognitive function include oxygen-related treatments for chronic obstructive pulmonary disease and obstructive sleep apnea syndrome, and hemodialysis for renal (kidney) failure. In contrast, certain surgical interventions such as coronary artery bypass surgery can negatively impact cognitive function in a subgroup of patients. Other treatments, such as antihypertensive (blood pressure) medications, have shown both positive and negative effects (albeit small) on cognitive function, sometimes even within the same individuals. For example, in studying the effects of six different antihypertensive agents on cognition, Dr. Matthew F. Muldoon and his colleagues at the University of Pittsburgh found that certain cognitive functions improved, whereas others declined, when people were taking blood pressure medication (Muldoon et al., 2002).

## SUMMARY

There are many aspects of health and disease that affect the brain and therefore our cognitive abilities. These influences can occur in people of all ages. Whereas good health habits are associated with better cognitive function, poor health habits are related to worse cognitive function. Various hormones, genetic factors, chronic medical diseases, and exposure to environmental toxins have also been shown to negatively impact cognitive function. Finally, whereas certain medical and surgical treatments have been shown to be beneficial to cognition, others may create

additional problems. Leading a healthy lifestyle and preventing and treating medical disease are critically important ways to try to preserve cognitive function across the life span.

—Shari R. Waldstein

See also CHRONIC DISEASE MANAGEMENT

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## COMMUNITY-BASED PARTICIPATORY RESEARCH

Community-based participatory research in public health is a partnership approach to research that equitably involves, for example, community members, organizational representatives, and researchers in all aspects of the research process. All partners contribute their expertise and share responsibility and ownership to enhance understanding of a given phenomenon and to integrate the knowledge gained with interventions to improve the health and well-being of community members (Israel, Schultz, Parker, & Becker, 1998).

There are a number of partnership approaches to research and action that span the social science literature, including participatory research, participatory action research, action research, cooperative inquiry, and empowerment evaluation (Israel et al., 1998). While these approaches differ on several dimensions, each includes the active involvement of all participants in the research process and a commitment to conducting research that will benefit those involved, through the use of research findings to guide policy change and/or through direct interventions. The use of the term *community-based participatory research* makes clear the emphasis on both conducting research within a community context and the critical role of participation and influence of community members in all aspects of the research process.

## KEY PRINCIPLES OF COMMUNITY-BASED PARTICIPATORY RESEARCH

There are a number of key principles or characteristics that guide the development and maintenance of a community-based participatory research (CBPR) partnership. While no one set of principles is applicable to all contexts and participants, there are core underlying perspectives that instruct CBPR efforts. The principles presented here are based on a synthesis of the present knowledge in the field. Although presented here as distinct items, CBPR processes serve to integrate these characteristics.

Drawing upon the literature on group process (Johnson & Johnson, 2003), these principles are relevant to any group that brings together people or organizations with different missions and goals, where there is a need to ensure equitable participation and influence in order to achieve ongoing engagement.

Furthermore, there is a particular emphasis within CBPR efforts to apply these principles in communities where long-standing economic and other inequalities contribute to differences in health status, in opportunities to participate in research, as well as mistrust of researchers and health professionals. Thus, these principles are applicable for research efforts aimed at improving health in all communities, as well as more specifically to those efforts aimed at reducing health disparities. (The principles described below are drawn from Israel et al., 1998, and Israel et al., 2002.)

1. *Acknowledges community as a unit of identity.* Community, as a unit of identity, involves a sense of emotional connection and identification with others, shared norms and values, common symbol systems, similar goals and interests, and desire to meet shared needs. Communities of identity may be either a defined geographic area (e.g., neighborhood) or a geographically dispersed group with a common sense of identity (e.g., ethnic group, gay men and lesbians). A city or other geographic area may include a number of different communities of identity or may be an aggregate of individuals who do not share a sense of identity. CBPR partnerships seek to work with existing communities of identity and also to enhance a sense of community through collaborative processes. Communities of identity may benefit from involving individuals and groups from outside the community who bring additional skills and resources that contribute to their goals.

2. *Begins with and builds on strengths and resources within the community.* CBPR acknowledges and builds on the strengths and resources that exist within communities of identity, for example, skills and assets of individuals, caring and helping networks of social relationships, and mediating structures such as faith-based and community-based organizations. CBPR strives to identify, support, and enhance these strengths and resources that enable community members to work together to improve health and quality of life.

3. *Promotes collaborative, equitable partnership in all aspects of the research, involving an empowering and power-sharing process.* CBPR emphasizes the development and maintenance of collaborative, equitable partnerships, in which all partners share influence and control over all aspects of the research process, starting with the identification by community

members of the issues and concerns to be addressed. Researchers involved in CBPR recognize the inequalities that often exist between themselves and community members. Efforts to create equitable partnerships in the face of these inequalities include the creation of structures and processes that facilitate sharing information, decision-making power, and resources among members of the partnership, with explicit attention to incorporating the expertise of community members.

4. *Facilitates colearning and capacity building among all partners involved.* CBPR promotes colearning and the reciprocal exchange of knowledge, skills, and capacity among all partners, with the goal of enhancing the effectiveness of the CBPR effort, as well as strengthening other endeavors in which partners are involved. For example, researchers learn from the local knowledge that community members have about their community's history, culture, politics, and broader social context, as well as from their administrative and management skills. Similarly, community members may further develop skills in areas such as conducting research and evaluation and grant proposal preparation, and smaller community-based organizations may enhance their capacity to serve as fiduciary for partnership grants.

5. *Combines and creates a balance between research and action for the mutual benefit of all partners.* CBPR aims to contribute to knowledge related to the determinants of health and well-being while combining and balancing that generation of knowledge with change efforts that benefit the communities involved. CBPR partnerships may agree that all research efforts not involve an intervention component, but they commit to the translation of research findings to intervention and policy strategies that will address the concerns of the community.

6. *Focuses on local relevance of public health problems and ecological approaches that address the multiple determinants of health and disease.* CBPR examines public health problems that are of local relevance to the community involved, acknowledging the concept of health from a positive perspective that considers physical, mental, and social well-being. CBPR also focuses on an ecological approach to health that involves individuals, the immediate context in which they live (e.g., family, social network), and the broader context in which they are embedded (e.g., community, society). Accordingly, this ecological

approach attends to multiple determinants of health and disease, including biomedical, social, economic, cultural, and physical environmental factors. CBPR efforts aim to address this complex set of determinants through the integration of multiple units of practice.

7. *Facilitates system development through a cyclical and iterative process.* CBPR facilitates the development of systems (e.g., a partnership) to engage in a cyclical, iterative problem-solving process. The steps in this process may include partnership development and maintenance, community assessment, problem definition, research design, methods development, data collection and analysis, interpretation of data, dissemination of findings, development and implementation of intervention strategies and policy implications, evaluation and specification of learnings, and creation of mechanisms for sustainability.

8. *Disseminates results to all partners and involves them in the dissemination process.* CBPR involves the dissemination of research findings to all partners involved, using language that is understandable and respectful. Feedback of data occurs on an ongoing basis, and results are used to guide interventions and policy changes. The dissemination of findings extends beyond the partnership itself and involves all partners as reviewers and coauthors of publications and as copresenters at conferences.

9. *Promotes a long-term process and commitment.* CBPR involves a long-term process and commitment on the part of all partners to follow the principles described above. CBPR emphasizes the establishment of relationships and commitments that extend beyond a single research project or funding period.

## RATIONALE FOR COMMUNITY-BASED PARTICIPATORY RESEARCH

As summarized by Barbara Israel and colleagues (1998), there are numerous advantages to CBPR that are discussed in the literature. Some of the key rationales for CBPR include that it improves the relevance and usefulness of the research findings; enhances the quality and validity of the research; brings together partners with diverse knowledge, skills and expertise to address complex issues; increases the likelihood of overcoming the understandable distrust of research by communities that have historically been excluded from and been the “subjects” of the research process; applies the knowledge gained to direct resources and

influence policies aimed at benefiting the community; builds bridges across cultural differences that may exist between the partners; strengthens the capacity of all partners to understand and address community concerns; provides additional resources and employment opportunities for marginalized communities; links communities that have been marginalized (based on, e.g., race, class, and gender) with researchers in investigating the effects of marginalization and in actions aimed at its elimination; and improves the health and well-being of the communities involved.

## CBPR EXAMPLE: THE DETROIT COMMUNITY-ACADEMIC URBAN RESEARCH CENTER

### Overview and Mission

There are numerous examples of community-based participatory research efforts that have addressed topics such as diabetes prevention and control, domestic violence, social determinants of health, cancer prevention, the physical environment and childhood asthma, access to quality health care, HIV/AIDS prevention, and environmental justice (for reviews of this literature see Israel et al. 1998; Green et al., 1995; Minkler & Wallerstein, 2002). Here we briefly discuss the Detroit Community-Academic Urban Research Center (URC) as an example of a CBPR partnership that involves representatives from community-based organizations, public health and health care agencies, and academia. The partner organizations are Butzel Family Center, Community Health and Social Services Center, Detroit Health Department, Detroit Hispanic Development Corporation, Friends of Parkside, Henry Ford Health System, Kettering Butzel Health Initiative, Latino Family Services, Southwest Counseling and Development Services, the University of Michigan Schools of Public Health and Nursing, Warren/Conner Development Coalition, and the Centers for Disease Control and Prevention (CDC). The URC began in 1995 and receives core funding from the CDC through its Urban Health Initiative.

The overall mission of the URC is to establish an effective community-based participatory research partnership to jointly identify factors affecting the health and well-being of residents on the east and southwest sides of Detroit and to implement and evaluate interventions and policies to address these factors in ways that recognize, build upon, and enhance the resources and strengths in the communities involved,



toward the end of reducing health disparities. The URC works in two geographic communities of identity: east-side Detroit, which is predominantly African American, and southwest Detroit, which is the area of the city in which the largest percentage of Latinos reside.

### Accomplishments and Benefits

An extensive evaluation of the partnership process has identified accomplishments and benefits of the URC (Israel et al., 2001; Lantz, Viruell-Fuentes, Israel, Softley, & Guzman, 2001). These include the adoption and implementation of operating procedures and CBPR principles; the development of trusting relationships among the partners involved; the implementation of 14 funded CBPR projects, addressing issues such as social determinants of health, diabetes prevention and management, the environment and childhood asthma, and access to quality health care (over \$27 million received); increased collaboration between the African American and Latino communities involved; the hiring of over 150 community members for full-time or part-time positions; the dissemination of results through numerous coauthored publications and presentations; the increased involvement of faculty and students in CBPR projects; and the increased involvement of community partners as guest lecturers in classes and as field preceptors for courses and internships.

### Challenges and Barriers

The URC evaluation has identified a number of challenges and barriers to conducting CBPR (Israel et al., 2001; Lantz et al., 2001). These include establishing and maintaining trust and working relationships among partners; identifying and agreeing upon priorities; managing the significant amount of time required to develop positive relationships and jointly carry out tasks; developing and implementing mutually agreed upon operating procedures (e.g., deciding who participates on the board, how they are selected, how meetings are conducted, how decisions are reached, such as consensus or majority vote); seeking a balance between time spent on process issues related to board development and completing specific tasks, as well as time spent on research as compared to intervention activities; working together across ethnic, cultural, social class, and organizational differences; following agreed upon CBPR principles in practice;

addressing questions raised concerning the scientific quality of the research; proving partnership and intervention success; convincing funders that CBPR may take more time to produce results than non-CBPR approaches; and competing institutional demands (e.g., publishing, grant writing, providing health and social services, community development) that limit the ability of partners to devote the requisite time for URC board and affiliated projects' activities.

### Lessons Learned and Recommendations for Conducting CBPR

A review of the literature on CBPR, including the experiences of the URC, suggests a number of lessons learned and recommendations for conducting CBPR. One of the strengths of a CBPR approach is that it is tailored to the local culture, history, resources, and needs of the communities involved, and thus, flexibility in adapting these lessons learned to new contexts is important. The following are key recommendations (see Israel et al., 1998, 2001, and 2002 for a more in-depth discussion):

- Jointly develop a set of CBPR principles and norms for how members of the partnership are going to work together.
- Establish a balance between the time spent on process issues and the tasks and activities that the partnership wants to conduct.
- Mutually identify and agree upon priority issues, goals, and objectives.
- Emphasize community strengths as well as problems.
- Define *community* and who represents the community (e.g., start small, involving a few highly regarded community-based organizations within communities of identity, gain support and involve top leadership from partner organizations, build on prior history of good working relationships).
- Establish dissemination procedures.
- Apply methodological flexibility and appropriate criteria for judging effectiveness.
- Create and maintain infrastructure.
- Achieve a balance in the distribution of benefits and resources.
- Build upon the cultural diversity of the partners involved.
- Conduct ongoing evaluation of the partnership process.

## CONCLUDING COMMENTS

Addressing disparities in health status between marginalized communities and those with greater access to social and economic resources requires the development of more equitable approaches to research and intervention that are beneficial to the communities involved. CBPR is one approach that involves diverse partners in strategies aimed at increasing knowledge and action to address community-identified needs. While there is no one approach to CBPR, those interested in conducting CBPR can draw upon the principles and lessons learned by others as they develop their own strategies for inquiry and change aimed at improving health and quality of life and reducing health disparities.

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See also COMMUNITY COALITIONS; CULTURAL FACTORS AND HEALTH; HEALTH DISPARITIES; PARTICIPATORY RESEARCH

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## COMMUNITY COALITIONS

Solving complex health issues requires addressing multiple risk factors using a variety of interventions aimed at changing individual, organizational, and community factors. In order to accomplish this, it is necessary to engage various agencies and community leaders and members in processes that allow them to work together effectively. Recognizing this, public health professionals have attempted to capitalize on naturally occurring coalitions that bring together the strengths, capacities, and social structures of communities and various agencies, or have attempted to create new coalitions among these groups. *A coalition is a group that comes together for a common purpose*. A coalition may act together to address the interests of all parties or collaborate to minimize duplication. While there are many different types of groups that individuals and organizations may be part of, and different people have different definitions and names for these groupings, for purposes of this entry a coalition has a diverse membership whose charge is to some extent self-defined or at least modified over time. A coalition may in certain instances be synonymous with what some have called partnerships. However, some partnerships may involve only two organizations with a defined task or set of activities and thus may differ from our current use of the term *coalition*. Similarly, individuals may form a group to accomplish a specific task. Such "task forces" or "teams" differ from our use of the term *coalition* in that they usually have a very clearly defined charge from the outset, are often dominated by professionals, and are not as diverse and fluid as a coalition.

Previous literature has identified several stages of coalition development, each with different tasks that

need to be accomplished in order to be effective. These stages include (a) preformation and formation, (b) action planning and implementation, (c) evaluation, and (d) institutionalization/sustainability.

#### PREFORMATION, FORMATION, AND MEMBERSHIP

Before considering the development of a coalition for creating changes in health and behavior, it is essential to understand the history of community relations, previous experiences with health projects, inter-group relations, and interorganizational relationships (particularly the levels of trust and respect among these individuals and groups), as well as community resources and values. It is also important to understand that other aspects of the social and economic context (e.g., experiences with discrimination and racism, and levels of poverty and unemployment) may influence motivation for and ease of working together. In practice, many coalitions form in response to an experienced need or event, and thus these issues may not be explicitly addressed at the time of formation. Even so, these issues will influence the ability of the coalition to move forward through the other stages and will need to be considered at some point.

The coalition may be composed of professionals from organizations (community organizations, health care centers, social service agencies), a group of grassroots community members, or some combination of these. The coalition may be initiated by funding agencies, professional organizations, or by a group of community members.

It is critical to make decisions regarding membership at the beginning of coalition activities. A coalition with individuals who are all focused on a single issue may limit input and creativity. Alternately, if the effort is categorical and a coalition of organizations and individuals with broad interests is developed, individuals may feel frustrated at being limited in the types of programs and policies that can be developed. In both cases, community support will be lessened rather than enhanced, and this will carry over to, and influence, future endeavors. Another consideration in considering membership of the coalition is agency versus community member involvement. A coalition of service organizations provides grounding in the community and is essential for community-based work. This is, however, different from a coalition in which community agencies/organizations, health

providers, and intended program recipients jointly define the issues to be addressed and plan, implement, and evaluate the programs and/or policies created to address these issues. Another consideration in developing coalition membership is the extent to which it is seen as beneficial to bring together a diverse group in terms of race, class, and ability. Such a diverse group can offer a range of expertise to enhance program effectiveness. Alternately, a diverse group may be able to increase the number of community members who take part in programs or offer support for the coalition agenda. The capacity to realize the benefit of such diversity depends on the level of commitment to ensure that all members have equal opportunities to engage in decision-making processes both within and outside the coalition and to influence the outcomes of the coalition activities. In order to do this, the organizational structure must be jointly defined and established by all coalition members.

In terms of purpose, some coalitions may be focused on categorical issues, such as breast cancer, development of a playground, or improving housing. Other coalitions may form to address broader public health issues such as improved overall access to health care services. Alternately, the process of developing, building, and maintaining relationships among coalition partners may be considered the primary purpose of the coalition.

Regardless of the narrow or broad focus, a coalition needs to decide the level of integration it wants to have with the other agencies and with community members. This can be thought of as a continuum of integration. On one end of the continuum is the desire of agencies and individuals to work together to identify gaps in services, avoid duplication of services, and exchange information to allow for appropriate client referral. The next level of integration involves agencies maintaining their autonomy, agendas, and resources, but beginning to share these resources to work on an issue that is identified as common to all agencies. The next level of integration involves each of the agencies lessening their level of autonomy and beginning to develop joint agendas, joint goals, and joint resources. The coalition may decide to implement joint programs or encourage other groups to implement programs that they collectively deem important and are willing to commit resources to ensure their development and implementation.

The level of integration that is appropriate depends on the desires of the agencies, the length of time that

the coalitions have worked together, and the nature of the problem (short-term “fixable” vs. long-term years to achieve change). Some coalitions may decide to start at a low level of integration and move to higher levels of integration over time; others may start with attempts to engage in projects that require full integration. What is most crucial is that all agencies and community members agree on the level of integration and jointly define their common goals as well as objectives to reach these goals.

In order to make decisions regarding the purpose of the coalition and the level of integration, it is necessary to develop processes for interaction. The ability to do this collaboratively is a function of the coalition’s structure and organization. This includes defining roles and responsibilities of different coalition members, the organization in terms of, for example, the existence and role of subcommittees, and formal and informal methods of communication. In addition, it is essential that coalitions act to define and build their group process skills. These skills include decision making, methods and types of participation among different coalition members, cultural competence, group facilitation, minute taking, agenda development, and conflict management. It is also important that the group structure incorporates methods of recognizing the contributions of both leaders and members. When considering the structural and organizational options, it is important to remember that individuals from different agencies and different community members each have different ways of engaging in these processes. Therefore, any choices regarding policies and procedures must consider the range of possibilities and include training opportunities so that all members of the coalition have the skills necessary to participate in whatever processes are chosen. Given that coalition membership often changes over time, it is critical that these training opportunities and orientation to the decisions made be provided to new members as they join the coalition.

## ACTION PLANNING AND IMPLEMENTATION

Regardless of the level of integration a coalition desires, some degree of skill in the area of action planning and implementation is essential. For some coalitions, the action steps may be to develop referral mechanisms (e.g., forms, shared telephone lists), while other coalitions may decide to implement specific programs or advocate for policy changes. In all

instances, there is some commonality of the skills required. For example, important planning skills include the ability to review existing data to determine priority issues and/or risk factors that contribute to the defined priorities, and to clearly define objectives and develop a work plan (see, e.g., Johnson et al., 1996, and the Community Tool Box, 2003, for additional tips for engaging in these steps).

Many coalitions have members who have these abilities and skills, while other coalitions may request outside technical assistance to engage in these processes. It is essential that these outside resources (consultants, practitioners, and/or academicians) understand and respect the coalition processes and structures and act accordingly. Participatory approaches that recognize the strengths and capacities of all partners (e.g., community-based participatory research) are important to consider when outside technical assistance is requested. In defining and implementing action plans, it is also important that the coalition have access to key decision makers, be able to create and leverage public pressure in support of their initiative, and have access to resources.

## EVALUATION

The evaluation of coalition activities should be consistent with the stage of coalition development. For example, initial evaluation activities should focus on issues such as structure, organization, the coalition’s ability to garner support, and participation of appropriate members. Later evaluation activities can focus on the ability of the coalition to achieve its stated goals and objectives as well as unintended outcomes (that may be positive or negative). In all cases, the methods used (qualitative or quantitative) should be based on the questions asked and the coalition’s ability to utilize the information. While it is important to evaluate coalition processes and outcomes, evaluation activities may be more or less formal and structured, depending on the resources available.

Previous research suggests that not all coalition efforts are successful or effective, and that at times the impact of successful coalitions may have gone undetected because of inappropriate (or weak) evaluation plans. Some common evaluation weaknesses include (a) an evaluation time frame that is too short, (b) an evaluation strategy that focuses on unrealistic, distant health outcomes instead of intermediate endpoints influenced by coalition activity, (c) measures that are

incapable of detecting valid indicators of change, and (d) alternative explanations for effects are not taken into account. For many coalition or partnership endeavors, a realistic scaling back of expectations will offer more opportunities for accountability.

#### INSTITUTIONALIZATION AND SUSTAINABILITY: THE NEED FOR A CRITICAL LENS

To sustain coalition activities, it is often important to assess existing needs and resources. In terms of resources, some coalitions operate with minimal costs expended by the coalition itself in terms of staff and facilities (often with other organizations donating some of these resources). These contributions may or may not continue as the coalition evolves. In addition, there are often personal costs associated with coalition involvement, including exacerbation of conflicts among members and/or other groups. In these instances, it is important to critically reflect on the specific coalition structure and organization and decide if it can achieve the stated goals and objectives. It is also important to assess the extent to which the coalition members and/or community as a whole has developed competing priorities and/or other needs for what are usually limited resources. These emerging community needs may in some instances require dissolving the existing coalition and supporting other coalitions, changing membership of existing coalitions, developing new coalitions, or supporting other approaches and endeavors.

—Elizabeth A. Baker and Ross C. Brownson

See also COMMUNITY-BASED PARTICIPATORY RESEARCH

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## COMORBID MENTAL AND OTHER PHYSICAL DISORDERS

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A range of studies has shown that many individuals suffer from mental and other physical disorders at the same time. The suffering experienced by individuals as a result, and the cost in lost productivity and health expenditures, is magnified well beyond the suffering and costs associated with either mental or other physical disorders alone.

Comorbid disorders occur across the life span, from early childhood through the oldest segments of our population, including those with terminal physical disorders. Yet the scope and nature of comorbid mental and other physical disorders remain largely unknown. Limited reliable and valid national or statewide epidemiological data on the incidence and prevalence of these comorbid disorders exist. Little is known about the mechanisms that link comorbid mental and other physical disorders, particularly mechanisms that have a relatively large influence on the development of these comorbid disorders and can also be modified through intervention. Thus, our ability to intervene to prevent or treat adverse comorbid mental and other physical outcomes is limited. While an extensive scientific literature shows that available medications and psychotherapy, especially in combination, effectively treat depression, few studies have specifically examined the optimal treatment approaches for the range of comorbid mental and other physical disorders.

Depression and anxiety are associated with major risk factors for a wide range of comorbid medical disorders, including several leading causes of death among Americans such as heart disease, cancer, strokes, and diabetes (Neugebauer, 1999). These risk factors include smoking, a harmful diet, and lack of regular exercise. By their nature, depression and anxiety, as well as the stigma associated with the disorders and interventions for them, can impede motivation, skills acquisition, and behavior change in all these areas.

The detrimental impact of mental disorders, independent of comorbidity with other physical disorders, in the United States and throughout the world is enormous. For example, according to World Health Organization estimates, unipolar major depression will become the second leading cause of disability worldwide by the year 2020, second only to heart disease (Murray & Lopez, 1996). Among women worldwide, depression will be the leading cause of disability. Other mental disorders, such as bipolar disorder, schizophrenia, and obsessive-compulsive disorders, are also major contributors to disability worldwide. In the United States, mental disorders such as depression and anxiety are prevalent and debilitating (Regier et al., 1993). Five percent to 12% of men and 10% to 25% of women have a major depressive episode during their lifetime, and many more have depressive disorders that fall short of criteria for major depressive disorder (Kessler et al., 1994).

Comorbid depression and heart disease are briefly discussed as examples because these two disorders are among the most common facing Americans and because this type of comorbidity has received far more research attention than any other. Heart disease is by far the leading cause of death in the United States among both men and women. If current trends continue, about one in three Americans will die of some form of heart disease. One out of every two American men and one out of every three women age 40 and younger develop heart disease at some time in their lives (Levy, 1999).

As yet, poorly understood mechanisms link depression and heart disease, although hypotheses include increased platelet aggregation and proinflammatory cytokines, and decreased heart rate variability (see Schulz, Martire, Beach, & Scheier, 2000, for a detailed discussion of potential mechanisms). Among men followed for 40 years, those who reported clinical depression were more than twice as likely to develop coronary artery disease than those who did not report clinical depression. The increased risk associated with clinical depression was present even for myocardial infarctions occurring 10 years after the onset of the first depressive episode (Ford et al., 1998).

Penninx et al. (2001) examined the risk for cardiac mortality in community-dwelling individuals over age 55 with and without cardiac disease at baseline. Individuals with depression were three to four times more likely to die over the next 4 years than those

without depression. Furthermore, those with diagnosable depression were about twice as likely to die as those with depressive symptoms.

A history of depression increases the risk of further depression during hospitalizations for heart disease and after discharge. Depression in hospital is associated with an increased risk of mortality 18 months after discharge (Frasure-Smith, Lesperance, & Talajic, 1995). Depression also appears to increase the risk for strokes. Simonsick, Wallace, Blazer, and Berkman (1995), in *Depressive Symptomatology and Hypertension-Associated Morbidity and Mortality in Older Adults*, found that among those age 65 and older, rates of stroke were 2.3 to 2.7 times higher in persons with "high" versus "low" levels of depressive symptoms. Mild depressive symptoms in those older than 65 are associated with an increased likelihood of becoming disabled and a decreased chance of recovery, regardless of age, sex, and other factors that contribute to physical disability (Cronin-Stubbs et al., 2000).

Thus, interventions aimed at comorbid disorders, such as depression and heart disease, would have enormous public health significance because of the widespread suffering caused by mental disorders themselves. For example, the average length of disability and the disability relapse rate associated with depression were equal to or greater than those associated with common, chronic medical problems such as diabetes, hypertension, recent myocardial infarction, and congestive heart failure (Hays, Wells, Sherbourne, Rogers, & Spritzer, 1995). While available medications and psychotherapy, especially in combination, effectively treat depression, more research is needed to find the optimal approaches for treating depression when it is comorbid with other specific physical disorders.

With respect to current treatment for mental disorders such as depression, depressed persons from the community are more likely to visit a primary care physician than a mental health professional, and most prescriptions for antidepressants are dispensed in general medical care (Ford, 2000; Regier et al., 1993). Between 30% and 40% of primary care patients screen positive for significant levels of emotional distress, and as many as 25% meet criteria for a mental disorder diagnosis (Roter et al., 1997). In one study, almost one third of individuals older than 60 visiting a primary care physician had at least one active mental disorder diagnosis (Lyness, Caine, King, Cox, & Yoediono, 1999). But half of mental disorders meeting

diagnostic criteria are not recognized by primary care physicians (Schulberg et al., 1996). Basic research, however, might facilitate physicians' ability to recognize and treat or refer individuals with depression.

Thus, much research is needed to improve our knowledge base and our ability to effectively intervene. This research should include (a) epidemiological studies that elucidate the frequency and distribution patterns of comorbid mental and other physical disorders across gender and racial/ethnic minority groups and the life span, (b) studies of biological, behavioral, and psychosocial risk and protective processes underlying comorbid mental and other physical disorders to clarify which processes have the greatest relative influence on the development of these disorders and can potentially be modified through intervention, (c) tests of innovative pharmacological, behavioral, psychosocial, or environmental interventions for comorbid disorders in actual practice settings, and (d) research on the impact of separate organizational systems and different financing mechanisms for comorbid mental and other physical disorders.

—Peter Muehrer

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## COMPLEMENTARY AND ALTERNATIVE MEDICINE

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A variety of terms (*complementary, alternative, unconventional, unproven, and unorthodox medicine*)

refer to approaches not part of standard medical practice in the Western world (Eisenberg et al., 1993). The term *complementary and alternative medicine* (CAM) is used most commonly to refer to these practices, but has not been well defined. CAM covers a broad range of healing philosophies, approaches, and therapies that mainstream Western (conventional) medicine does not commonly use, accept, study, or make available (National Center for Complementary and Alternative Medicine [NCCAM], 2002a). Some offer systems of assessment and treatment (e.g., homeopathy, traditional Chinese medicine, ayurveda); others complement conventional treatment with various supportive practices, products, or techniques (e.g., herbal remedies, meditation training).

The National Institutes of Health Panel on Definition and Description of CAM in 1995 defined CAM as “a broad domain of healing resources that encompasses all health systems, modalities and practices and their accompanying theories and beliefs, other than those intrinsic to the politically dominant health system of a particular society or culture in a given historical period” (p. 50). However, this and many other definitions fail to identify what CAM actually is, which is a prerequisite for development of a valid body of knowledge about CAM use and its determinants. To address this, categories of CAM have been distinguished. For example, NCCAM (2002b) has identified five major CAM domains: alternative medical systems, mind-body interventions, biologically based treatments, manipulative and body-based methods, and energy therapies.

Another problematic issue related to labeling and defining CAM is the use of the term *medicine*. Instead of *medicine*, the term *health care* has been proposed (Crellin, Andersen, & Connor, 1997; Health Canada, 2001). Health care consists of all services, products, and activities used by individuals for the purpose of promoting, maintaining, monitoring, or restoring health (Last, 1983). Many CAM users and practitioners are focused on prevention more than treatment.

A thorny challenge has been the distinction (or lack thereof) between “complementary and alternative medicine” and behavioral medicine. Within the National Institutes of Health, offices for both areas were established to encourage cross-institute initiatives; however, the broad and vague definition of CAM led to considerable overlap between the two. Such trends as increased coverage of CAM within managed care without differentiating practices with a

solid foundation in behavioral research exacerbated the problem. While there now is considerable rapprochement (e.g., the creation within the Society of Medicine of a special interest group: Complementary, Alternative, and Integrative Medicine), fundamental conceptual issues remain.

## CONCEPTUAL DIFFERENCES BETWEEN CAM AND CONVENTIONAL MEDICINE

Many types of CAM, in particular complementary health systems, have a common underlying philosophy that includes a focus on health and improving well-being, rather than on disease (Micozzi, 1996). CAM systems are based on a holistic paradigm, which views diseases as having multiple causes amenable to multiple therapeutic interventions through a variety of biochemical, environmental, psychological, social, spiritual, and energetic forces. Therefore, making a diagnosis does not focus on objective signs and symptoms but on evaluating the nature of physical, emotional, structural, or energetic imbalance. Treatment focuses on attempts to strengthen constructive forces and restore balance, based on the fundamental belief in the self-healing capacity of the body. While biomedicine tends to assume that all individuals are basically the same and treats individuals with similar diagnoses the same, CAM is more likely to assume that all individuals are different and, therefore, treatment consists of individualized constellations of therapeutic activities. These features lead to the encouragement of active participation in disease management rather than passive acceptance of prescribed treatment. It should be clear that these differences may be overstated and a matter of degree rather than a clear dichotomy. For example, the patient-centered approach to patient care, increasingly promoted in family medicine (Stewart et al., 1995), emphasizes a holistic philosophy.

## CAM USE

Throughout history, people have used approaches that replace or complement conventional health care. However, it was not until the early 1990s that the extent of this behavior became clear. Eisenberg et al. (1993) were the first to examine CAM use by the general population. They found that 34% of Americans had used at least one alternative treatment during the past year (1990) and 11% had seen an alternative



health care provider. One of the most frequently discussed findings of this study is that about 60% of respondents did not inform their medical doctor of their use of CAM. In a follow-up survey in 1997 (Eisenberg et al., 1998), CAM use had increased to 42%. Fifty-eight percent of CAM treatments were used, at least in part, to prevent illness from occurring or to maintain health and vitality. There was no change in disclosure rates.

Utilization rates in other countries have been estimated at 50% in Canada (Ramsay, Walker, & Alexander, 1999), 49% in Australia (MacLennan, Wilson, & Taylor, 1996), 28% in the United Kingdom, and 65% in Germany (Pittler, 2001). These differences in rates may be partly due to differences in the definition of CAM. For example, some surveys differentiate explicitly between CAM practices and substances and CAM practitioners, and others combine them. Due to these differences, it is difficult to compare CAM use between these countries. Relaxation techniques, herbal medicine, massage therapy, and chiropractic were most common in the United States and Canada (Eisenberg et al., 1998; Ramsay et al., 1999). In Australia, vitamins (nonprescribed) and mineral supplements were commonly mentioned (MacLennan et al., 1996). There are many differences within and between countries in Europe; however, the use of homeopathy and acupuncture appears to be common (Pittler, 2001). CAM use also varies with geographic, historical, and political settings and acceptance by the medical community.

These surveys generally show that CAM users are more likely to be female, be better educated, have higher incomes, and to have chronic conditions (from allergic to musculoskeletal as well as terminal or potentially terminal illness). A recent survey (Druss & Rosenheck, 1999) suggested that less than 2% of the population relies solely on alternative care, supporting the use of the term complementary rather than alternative medicine.

### Reasons for CAM Use

Furnham (1994) distinguished between factors “pulling” people toward CAM and factors “pushing” people away from conventional medicine. These factors form hypotheses about reasons for CAM use, which could potentially assist in predicting whether people will use CAM and which CAM approach they will use. Push factors include dissatisfaction with

conventional medicine, such as lack of effectiveness, adverse effects, and poor patient-physician communication. Pull factors include compatibility between the underlying philosophy of certain approaches and patients’ own beliefs (such as holism, emphasis on well-being, and an active patient role), personal control over treatment, patient-practitioner relationship (e.g., on equal terms, time for discussion and attention to emotional, spiritual, and other nonphysical factors), and belief in the effectiveness of CAM.

Astin (1998) tested the relationships between dissatisfaction with conventional care, need for personal control, and philosophical congruence with own beliefs in a random sample of 1,035 American residents. He found that only philosophical congruence was predictive of CAM use. Rather than being pushed toward CAM due to disillusionment, participants were pulled toward CAM because it is seen as more compatible with their values and beliefs about health and illness. Surveys of specific patient populations suggest that for some categories of patients, different reasons apply than for others. In addition, it is misleading to combine all CAM modalities, as reasons for the use of one may be different from reasons to use others.

Current societal trends are influencing the growth in CAM use. These include the increase in prevalence of chronic diseases; increasing access to health information, in particular via the Internet; increased interest in well-being and personal spirituality; declining faith that scientific breakthroughs in conventional medicine will have positive effects on personal health; and an increase in personal responsibility and shared decision making (e.g., Jonas, 2000).

### EVIDENCE-BASED CAM PRACTICE

CAM is criticized for the lack of empirical evidence of effectiveness. Many CAM systems have been around largely unchanged for centuries, and the central principles of these traditions have not been advanced with new observations, hypotheses-driven testing, or peer review. The unprecedented growth of CAM has outstripped our ability to provide the evidence base needed to ensure appropriate efficacy and safety guidelines. In addition, current methods to assess efficacy, such as randomized controlled trials, are not as easy to apply to CAM as to conventional treatments. Clinical investigations are complicated by the fact that many CAM treatments involve complex, individualized treatments and many herbal

preparations/oral supplements that lack standardization. Conventional outcomes measures often are not appropriate, as they do not fit with the CAM philosophy, for example, quality-of-life measures that lack a spiritual component. Patients often have strong beliefs about CAM interventions, which affect recruitment and randomization. Finally, the patient-provider relationship is considered a crucial part of the intervention, rather than a confounding variable (Nahin & Straus, 2001).

Arising from both the lack of research and the lack of regulation is the potential for harms resulting from CAM. CAM is often seen as more natural and, therefore, safe. However, many direct effects such as allergic or toxic reactions or drug interactions have been identified. Indirect harms consist of missed diagnoses or delaying diagnosis or conventional treatment. Harm in this case may be due to insufficient or substandard training of CAM practitioners. Finally, unjustifiable financial or emotional hardships have been identified as indirect harms.

## FUTURE DIRECTIONS

Demand for CAM will continue to expand. The big question for the future is whether CAM will be able to coalesce across therapies and develop its own organizational structure independent of medicine. Or will it eventually be incorporated into the conventional medical system as the evidence base develops? It is too early to say. Different health care systems will find different solutions, and what evolves may be a mixture of several options.

The concept of integrated medicine has been developing rapidly over the past 2 to 4 years, but so far, it is poorly defined. One useful definition is based on the work of Way and Jones (2000): "Integrative practice is an inter-professional process for communication and decision making that enables the separated and shared knowledge and skills of care providers to synergistically influence the client/patient care provided" (p. 3). Health care consumers are relatively advanced in integrating CAM and conventional medicine, and they select practitioners and products from all categories of health care services to create a package that meets their personal needs and beliefs. Consumer demand has spurred some conventional health care providers to make referrals to CAM practitioners, to provide some of these services, and to become educated regarding safety, efficacy, and underlying assumptions of different CAM approaches.

Partly based on consumer and practitioner involvement in integrated care, there is an increasing number of new initiatives in the United States, Canada, and Europe that seek to provide integrated health care using new and innovative models. However, at institutional, professional, regulatory, and health policy and system levels, integration is not (yet) taking place to any major degree. In a thoughtful article, Bausell and Berman (2002) have described the issues around integrative medicine as a "consumer driven continuation of the biomedical versus the biopsychosocial controversy" (p. 28). They suggest that the public itself may be in the process of inextricably changing medicine with or without the discipline's blessing or consent. Whatever the outcome, it is essential that investigators, CAM, and conventional health care providers and policymakers aim for the provision of "both good medicine and good science" (Bausell & Berman, 2002, p. 32).

The final question is how health and behavior researchers will respond to this opportunity. As a community, behavioral and social scientists have much to offer based on the long tradition of effective research to practice in areas such as behavioral medicine and health promotion. To the extent that the CAM community and the health and behavior research community share a common vision of evidence based and integrated practice, they might gain from working together. A useful first step would be to collaborate on issues related to definition, delivery models, and research methods.

—Marja J. Verhoef and Allan Best

See also EVIDENCE-BASED BEHAVIORAL MEDICINE

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## CONFOUNDER. See CONFOUNDING

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## CONFOUNDING

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The word *confounding* has been used to refer to at least three distinct concepts. In the oldest and most widespread usage, confounding is a source of bias in estimating causal effects. This bias is sometimes informally described as a mixing of effects of extraneous factors (called confounders) with the effect of interest. This usage predominates in nonexperimental research, especially in epidemiology and sociology. In a second and more recent usage originating in statistics, confounding is a synonym for a change in an effect measure upon stratification or adjustment for extraneous factors (a phenomenon called *noncollapsibility* or *Simpson's paradox*). In a third usage, originating in the experimental-design literature, confounding refers to inseparability of main effects and interactions under a particular design. The three concepts are closely related and are not always distinguished from one another. In particular, the concepts of confounding as a bias in effect estimation and as noncollapsibility are often treated as equivalent, even though they are not. Only the former concept will be described here; for more detailed coverage and comparisons of concepts see Greenland and Rothman (1998), Greenland and Pearl (1999), Greenland and Morgenstern (2001), and Pearl (2000).

## CONFOUNDING AS A BIAS IN EFFECT ESTIMATION

A classic discussion of confounding in which explicit reference is made to “confounded effects” is Mill (1843/1956, chap. 10), although in Chapter 3 Mill lays out the primary issues and acknowledges Francis Bacon as a forerunner in dealing with them. There, he lists a requirement for an experiment intended to determine causal relations:

None of the circumstances [of the experiment] that we do know shall have effects susceptible of being *confounded* with those of the agents whose properties we wish to study [emphasis added].

In Mill’s time, the word *experiment* referred to an observation in which some circumstances were under the control of the observer, as it still is used in ordinary English, rather than to the notion of a comparative trial. Nonetheless, Mill’s requirement suggests that a comparison is to be made between the outcome of our “experiment” (which is, essentially, an uncontrolled trial) and what we would expect the outcome to be if the agents we wish to study had been absent. If the outcome is not as one would expect in the absence of the study agents, then Mill’s requirement ensures that the unexpected outcome was not brought about by extraneous “circumstances” (factors). If, however, those circumstances do bring about the unexpected outcome, and that outcome is mistakenly attributed to effects of the study agents, then the mistake is one of confounding (or confusion) of the extraneous effects with the agent effects.

Much of modern literature follows the same informal conceptualization given by Mill. Terminology is now more specific, with *treatment* used to refer to an agent administered by the investigator and *exposure* often used to denote an unmanipulated agent. The chief development beyond Mill is that the expectation for the outcome in the absence of the study exposure is now almost always explicitly derived from observation of a control group that is untreated or unexposed. For example, Clayton and Hills (1993) state of observational studies,

There is always the possibility that an important influence on the outcome . . . differs systematically between the comparison [exposed and unexposed] groups. It is the possible [that] part of the apparent effect of exposure

is due to these differences, [in which case] the comparison of the exposure groups is said to be *confounded* [emphasis in the original].

In fact, confounding is also possible in randomized experiments owing to systematic improprieties in treatment allocation, administration, and compliance. A further and somewhat controversial point is that confounding (as per Mill’s original definition) can also occur in perfect randomized trials due to *random* differences between comparison groups (Fisher, 1935).

## THE POTENTIAL-OUTCOME MODEL

Various models of confounding have been proposed for use in statistical analyses. Perhaps the one closest to Mill’s concept is based on the *potential-outcome* or counterfactual model for causal effects. Suppose we wish to consider how a health-status (outcome) measure of a population would change in response to an intervention (population treatment). More precisely, suppose our objective is to determine the effect that applying a treatment  $x_1$  had or would have on an outcome measure  $\mu$  relative to applying treatment  $x_0$  to a specific target population A. For example, Cohort A could be a cohort of breast-cancer patients, treatment  $x_1$  could be a new hormone therapy,  $x_0$  could be a placebo therapy, and the measure  $\mu$  could be the 5-year survival probability. The treatment  $x_1$  is sometimes called the *index* treatment, and  $x_0$  is sometimes called the *control* or *reference* treatment (which is often a standard or placebo treatment).

The potential-outcome model posits that, in Population A,  $\mu$  will equal  $\mu_{A1}$  if  $x_1$  is applied,  $\mu_{A0}$  if  $x_0$  is applied; the causal effect of  $x_1$  relative to  $x_0$  is defined as the change from  $\mu_{A0}$  to  $\mu_{A1}$ , which might be measured as  $\mu_{A1} - \mu_{A0}$  or  $\mu_{A1}/\mu_{A0}$ . If A is given treatment  $x_1$ , then  $\mu$  will equal  $\mu_{A1}$  and  $\mu_{A1}$  will be observable, but  $\mu_{A0}$  will be unobserved. Suppose, however, we expect  $\mu_{A0}$  to equal  $\mu_{B0}$ , where  $\mu_{B0}$  is the value of the outcome  $\mu$  observed or estimated for a population B that was administered treatment  $x_0$ . The latter population is sometimes called the control or reference population. *Confounding* is said to be present if  $\mu_{A0} \neq \mu_{B0}$ , for then there must be some difference between Populations A and B (other than treatment) that is affecting  $\mu$ .

If confounding is present, a naive (crude) association measure obtained by substituting  $\mu_{B0}$  for  $\mu_{A0}$  in an effect measure will not equal the effect measure, and

the association measure is said to be *confounded*. For example, if  $\mu_{A0} \neq \mu_{B0}$ , then  $\mu_{A1} - \mu_{B0}$ , which measures the association of treatments with outcomes *across* the populations, is confounded for  $\mu_{A1} - \mu_{A0}$ , which measures the effect of treatment  $x_1$  on Population A. Thus, to say an association measure  $\mu_{A1} - \mu_{B0}$  is confounded for an effect measure  $\mu_{A1} - \mu_{A0}$  is to say these two measures are not equal.

The preceding potential-outcome model of confounding gradually emerged through attempts to separate effect measures into a component due to the effect of interest and a component due to extraneous effects (Bross, 1967; Groves & Ogburn, 1928; Kitagawa, 1955; Miettinen, 1972). It is closely related to graphical (causal diagram) and structural-equations models familiar in social sciences (Greenland & Brumback, 2002). One noteworthy aspect of this approach is that confounding depends on the outcome measure. For example, suppose populations A and B have a different 5-year survival probability  $\mu$  under placebo treatment  $x_0$ ; that is, suppose  $\mu_{B0} \neq \mu_{A0}$ , so that  $\mu_{A1} - \mu_{B0}$  is confounded for the actual effect  $\mu_{A1} - \mu_{A0}$  of treatment on 5-year survival. It is then still possible that 10-year survival,  $m$ , under the placebo would be identical in both populations; that is,  $\mu_{A0}$  could still equal  $\mu_{B0}$ , so that  $\mu_{A1} - \mu_{B0}$  is not confounded for the actual effect of treatment on 10-year survival. (We should generally expect no confounding for 200-year survival, since no treatment is likely to raise the 200-year survival probability of human patients above zero.)

A second noteworthy point is that confounding depends on the target population of inference. The preceding example, with A as the target, had different 5-year survivals  $\mu_{A0}$  and  $\mu_{B0}$  for A and B under placebo therapy, and hence  $\mu_{A1} - \mu_{B0}$  was confounded for the effect  $\mu_{A1} - \mu_{A0}$  of treatment on Population A. A lawyer or ethicist may also be interested in what effect the hormone treatment would have had on Population B. Writing  $\mu_{B1}$  for the (unobserved) outcome under treatment, this effect on B may be measured by  $\mu_{B1} - \mu_{B0}$ . Substituting  $\mu_{A1}$  for the unobserved  $\mu_{B1}$  yields  $\mu_{A1} - \mu_{B0}$ . This measure of association is confounded for  $\mu_{B1} - \mu_{B0}$  (the effect of treatment  $x_1$  on 5-year survival in Population B) if and only if  $\mu_{A1} \neq \mu_{B1}$ . Thus, the same measure of association,  $\mu_{A1} - \mu_{B0}$ , may be confounded for the effect of treatment on neither, one, or both of Populations A and B, and may or may not be confounded for the effect of treatment on other targets.

## CONFOUNDERS (CONFOUNDING FACTORS)

A third noteworthy aspect of the potential-outcome model is that it invokes no explicit differences (imbalances) between Populations A and B with respect to circumstances or covariates that might influence  $\mu$  (Greenland & Robins, 1986). Clearly, if  $\mu_{A0}$  and  $\mu_{B0}$  differ, then A and B must differ with respect to factors that influence  $\mu$ . This observation has led some authors to define confounding as the presence of such covariate differences between the compared populations. Nonetheless, confounding is only a consequence of these covariate differences. In fact, A and B may differ profoundly with respect to covariates that influence  $\mu$ , and yet confounding may be absent. In other words, a covariate difference between A and B is a necessary but not sufficient condition for confounding. This is because the impact of covariate differences may balance each other out, leaving no confounding.

Suppose now that Populations A and B differ with respect to certain covariates, and that these differences have led to confounding of an association measure for the effect measure of interest. The responsible covariates are then termed *confounders* of the association measure. In the above example, with  $\mu_{A1} - \mu_{B0}$  confounded for the effect  $\mu_{A1} - \mu_{A0}$ , the factors responsible for the confounding (i.e., the factors that led to  $\mu_{A0} \neq \mu_{B0}$ ) are the confounders. It can be deduced that a variable cannot be a confounder unless it can affect the outcome parameter  $\mu$  within treatment groups and it is distributed differently among the compared populations (e.g., see Yule, 1903, who however uses terms such as “fictitious association” rather than confounding). These two necessary conditions are sometimes offered together as a definition of a confounder.

Nonetheless, counterexamples show that the two conditions are not sufficient for a variable with more than two levels to be a confounder (Greenland et al., 1999).

## PREVENTION OF CONFOUNDING

Perhaps the most obvious way to avoid confounding in estimating  $\mu_{A1} - \mu_{A0}$  is to obtain a reference population B for which  $\mu_{B0}$  equals  $\mu_{A0}$ . Among epidemiologists, such a population is sometimes said to be *comparable* to or *exchangeable* with A with respect to the outcome under the reference treatment. In practice, such a population may be difficult or

impossible to find. Thus, an investigator may attempt to construct such a population, or to construct exchangeable index and reference populations. These constructions may be viewed as design-based methods for the control of confounding.

Perhaps no approach is more effective for preventing confounding by a known factor than *restriction*. For example, gender imbalances cannot confound a study restricted to women. However, there are several drawbacks: restriction on enough factors can reduce the number of available subjects to unacceptably low levels and may greatly reduce the generalizability of results as well. Matching the treatment populations on confounders overcomes these drawbacks and, if successful, can be as effective as restriction. For example, gender imbalances cannot confound a study in which the compared groups have identical proportions of women.

Unfortunately, differential losses to observation may undo the initial covariate balances produced by matching. Neither restriction nor matching prevents (although it may diminish) imbalances on unrestricted, unmatched, or unmeasured covariates. In contrast, *randomization* offers a means of dealing with confounding by covariates not accounted for by the design. It must be emphasized, however, that this solution is only probabilistic and subject to severe constraints in practice.

Randomization is not always feasible or ethical, and many practical problems, such as differential loss and noncompliance, can lead to confounding in comparisons of the groups actually receiving treatments  $x_1$  and  $x_0$ . One somewhat controversial solution to non-compliance problems is *intent-to-treat analysis*, which defines the comparison groups A and B by treatment assigned rather than treatment received. Confounding may, however, affect even intent-to-treat analyses, and (contrary to widespread misperceptions) the bias in those analyses can be away from the null (exaggerating an effect) (Robins, 1998). For example, the assignments may not always be random, as when blinding is insufficient to prevent the treatment providers from protocol violations. And, purely by bad luck, randomization may itself produce allocations with severe covariate imbalances between the groups (and consequent confounding), especially if the study size is small (Fisher, 1935; Rothman, 1977). *Blocked* (matched) randomization can help ensure that random imbalances on the blocking factors will not occur, but it does not guarantee balance of unblocked factors.

## ADJUSTMENT FOR CONFOUNDING

Design-based methods are often infeasible or insufficient to prevent confounding. Thus, there has been an enormous amount of work devoted to analytic adjustments for confounding. With a few exceptions, these methods are based on observed covariate distributions in the compared populations. Such methods can successfully control confounding only to the extent that enough confounders are adequately measured. Then, too, many methods employ parametric models at some stage, and their success may thus depend on the faithfulness of the model to reality. These issues cannot be covered in depth here, but a few basic points are worth noting.

The simplest and most widely trusted methods of adjustment begin with *stratification* on confounders. A covariate cannot be responsible for confounding within internally homogeneous strata of the covariate. For example, gender imbalances cannot confound observations within a stratum composed solely of women. More generally, comparisons within strata cannot be confounded by a covariate that is unassociated with treatment within strata. This is so regardless of whether the covariate was used to define the strata. Thus, one need not stratify on all confounders in order to control confounding. Furthermore, if one has accurate background information on relations among the confounders, one may use this information to identify sets of covariates sufficient for control of confounding (Pearl, 2000).

Some controversy has occurred about adjustment for covariates in randomized trials. Although Fisher asserted that randomized comparisons were “unbiased,” he also pointed out that they could be confounded in the sense used here (see Fisher, 1935, p. 49). Resolution comes from noting that Fisher’s use of the word *unbiased* referred to the design, and was not meant to guide analysis of a given trial. Once the trial is under way and the actual treatment allocation is completed, the unadjusted treatment-effect estimate will be biased if the covariate is associated with treatment, and this bias can be removed by adjustment for the covariate (Rothman, 1977; Greenland & Robins, 1986).

—Sander Greenland

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## CONTROL AND HEALTH

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When individuals are able to determine or influence what is happening to them, or what will happen to them, those individuals are said to be “in control.” Control is a central construct in psychology, and being in control is a universally desired state of existence for most persons. In the health care arena, control has typically been linked to positive health outcomes (Walker, 2001). Control can be either real or illusory

(Taylor & Brown, 1988). In the latter case, it is the perception of control that matters, especially because the amount of real control we can have over our health is limited. Whether or not one can actually influence health behaviors and outcomes, the perception that one has control is often sufficient to reap its benefits.

Most of the work concerning control and health has involved control beliefs rather than actual control. *Beliefs* about control in the context of health refer to the thoughts (or cognitions) an individual has regarding the ability to influence health behavior, health status (or other health outcomes), or health care. Control beliefs are one of a number of hypothesized determinants of health behavior and health outcome (Wallston, 2001a, 2001b).

## TYPES OF CONTROL BELIEFS

### Locus of Control

Rotter (1966) coined the term “locus of control” to refer to an individual’s belief as to whether control of valued reinforcements (i.e., outcomes) is *internal*—that is, due to who the individual is or what the individual does—versus *external*—that is, due to the actions of other people, fate, luck, or chance. Locus of control (LOC) is a generalized expectancy construct within Rotter’s (1954) social learning theory. Generalized expectancies are traitlike in that they guide behavior across many situations in respect to many reinforcers. Rotter (1966) conceived of LOC as being unidimensional, and the I-E Scale he developed to assess this construct was scored accordingly: high scores on the I-E Scale reflected an external belief orientation, while low scorers were called “internals.” Strickland (1978) reviewed the early studies linking the I-E Scale to physical and mental health variables.

Following Rotter’s lead, a unidimensional health locus of control (HLC) instrument was developed and published by Wallston, Wallston, Kaplan, and Maides (1976). In their initial studies, Wallston et al. (1976) demonstrated that the HLC Scale did a better job than Rotter’s I-E Scale in predicting health-related information-seeking and weight loss, especially for individuals who highly valued good health as a reinforcement. Health researchers began to choose the HLC Scale over the I-E Scale when studying health-related phenomena.

By the mid 1970s, however, researchers began to question the unidimensionality of both the I-E and HLC scales. Internality and externality were seen as

orthogonal dimensions rather than opposite ends of a continuum. Levenson (1973) developed the I, P, and C Scales to assess separately internal LOC beliefs from two types of external LOC beliefs: powerful others and chance. Following Levenson's schema, Wallston, Wallston, and DeVellis (1978) published Forms A and B of the Multidimensional Health Locus of Control (MHLC) Scales. These two forms of the MHLC have a similar factor-structure to Levenson's scales and have been widely used by health researchers throughout the world looking for a measure of control over one's health status. Early work with these measures was reported in two chapters (Wallston & Wallston, 1981, 1982). The most consistent findings have been (a) internal HLC is related to carrying out recommended health behaviors, especially by individuals who highly value good health, (b) internal HLC is related to self-reported health status, and (c) chance HLC is related to depressed mood and other indicators of psychological distress.

Form C of the MHLC (Wallston, Stein, & Smith, 1994) is a generic instrument intended for individuals already diagnosed with a medical condition. By changing the word *condition* in each item, Form C is used to assess persons' LOC beliefs over a particular existing health problem (e.g., arthritis, cancer, diabetes). The "powerful others" dimension in Form C is further broken down into two separate dimensions: doctors and other people. In keeping with an increasing interest in religion and health, Wallston and colleagues (Wallston et al., 1999) have developed a God Locus of Health Control subscale as a means of assessing persons' beliefs about God's control of their health. This new subscale can be used independently or in conjunction with any of the other forms of the MHLC.

Regardless of which form of the MHLC is administered, the preponderance of research with these scales has shown that health *locus* of control beliefs, by themselves, only account for a relatively small percentage of the variance in measures of health behavior and/or health status (Wallston, 1992, 2001b). The *place* where control is perceived to reside is less important than whether or not the individual believes that control exists, even if that control is illusory (Wallston, 2001a, 2001b). Other types of control-related beliefs (enumerated below) often explain a greater amount of variance in health-related measures than does LOC. LOC measures, such as the MHLC, may perform better as moderators than as main effect

predictors (Wallston, 1992; Wallston & Smith, 1994). For instance, the interaction of trust of doctors and the belief that doctors are responsible for one's health status may be more predictive of adherence to one's medical regimen than either predictor alone.

### Perceived Competence, Mastery, and Self-Efficacy

Whereas locus of control is only an imperfect indicator of the perception of control, other constructs such as perceived competence, mastery, and self-efficacy are more directly indicative of the belief that one is in control, particularly of one's behavior. Both mastery (Pearlin & Schooler, 1978) and perceived competence (cf. White, 1959) refer to control over situations and outcomes, as well as to behaviors. Self-efficacy, as originally conceived of by Bandura (1977), was highly situation-specific; it stood for the degree of confidence a person had in his or her ability to successfully carry out a specific behavior in a specific situation. Over the years, Bandura and others have endorsed a generalization of the self-efficacy construct so that it now is more similar to a sense of mastery or perceived competence (see Bandura, 1997). Persons are self-efficacious to the degree that they believe they can do whatever is necessary to obtain valued reinforcements in whatever situation they find themselves. Another close construct to self-efficacy is perceived behavioral control, a key predictor of behavior and behavioral intention in Ajzen's Theory of Planned Behavior (Ajzen, 1991).

As with LOC, attempts have been made to develop health-related measures of self-efficacy and perceived competence. An example of the former is the arthritis self-efficacy scales developed by Kate Lorig and her colleagues (Lorig, Chastain, Ung, Shoor, & Holman, 1989). Clinical researchers have used these measures as indicators of mediators of outcomes of a self-management program for persons with arthritis and other chronic medical conditions (Lorig, Mazonson, & Holman, 1993). The Perceived Health Competence Scale (Smith, Wallston, & Smith, 1995) is an example of the latter approach. Persons scoring high on the PHCS have high scores on self-rated health and psychological well-being (Smith et al., 1995).

### Learned Helplessness

Feeling helpless is the opposite of feeling in control. When a person feels helpless, the person believes



there is nothing he or she can do to improve a bad situation (such as being diagnosed with a terminal illness or being told that there are no treatments for a serious medical condition). Like other beliefs, helplessness is learned (Seligman, 1975). Believing oneself to be helpless in the face of adverse health circumstances is associated with motivational, behavioral, and affective deficits (Walker, 2001). As an example of research done with this construct, Stein, Wallston, and Nicassio (1988) showed that believing oneself helpless in the face of rheumatoid arthritis correlates highly with depressive symptomatology, pain, and functional impairment, and also that changes over time in arthritis helplessness predicts change in pain and depressive symptoms.

## ALTERING CONTROL

The vast majority of research relating control and health has been correlational in design, and much of that research has been cross-sectional rather than longitudinal. Typically, one or two measures of perceived health control are correlated with one or more measures of health behavior or health status. When a positive association is found using this type of research design, it is difficult to determine whether there is a causal relationship between control and health, and, if so, what the causal direction really is. It is, perhaps, more logical to conclude that perceptions of control over health are determined by knowledge of one's prior health behavior or health status than vice versa. Only by manipulating the degree of control a person has, or *thinks* one has, and measuring subsequent changes in health behavior or health status can researchers hope to pin down the causal path between control and health.

It is not unreasonable to assert that most forms of health education, disease prevention, and patient education are designed to give patients more control, or a greater sense of control, over their health. Many of these programs assess participants' self-efficacy or other control beliefs as one means of evaluating whether or not the program is effective in meeting its goals. Shapiro and Astin (1998) developed "control therapy" as an integrated approach to psychotherapy, health, and healing, and advocate using this type of therapy to increase a person's sense of control. The positive health benefits that typically occur for participants who engage in some form of cognitive-behavioral therapy are often mediated by an increase in control-related beliefs. Providing patients with

greater control over some aspect of their health care delivery—for instance, by giving them increased information about what will happen to them and why, or by giving them choices over some aspect of their care—has been shown to lead to lower distress and faster recovery (Wallston, 1989). Sinclair, Wallston, Dwyer, Blackburn, and Fuchs (1998) showed that women with rheumatoid arthritis who underwent mastery effectiveness training increased their sense of control and psychological well-being.

## Desire for Control

Perception of control should not be confused with desire for control, a motivational construct. Most individuals would like to have control over their health status, but this is separate and distinct from whether they feel they have such control (Wallston, 1989). Not everybody wants to have control over their health care, even if they have an internal locus of health control orientation. Without a concomitant sense of self-efficacy or health competence, many individuals prefer to leave control of health care up to physicians and other expert health care providers, such as nurse practitioners.

—Ken Wallston

See also SELF-EFFICACY

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## COST-EFFECTIVENESS

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The term *cost-effectiveness* has been used in a number of different contexts and can have a number of different intended meanings. In the broadest sense, the term *cost-effectiveness* has been used to describe whether the value that something produces is worth what it costs. For example, a person may state that it was cost effective to hire a new employee because the new employee's productivity has increased revenues.

In the context of health and behavior, cost-effectiveness can also be used broadly or more specifically. In the broader sense, it describes the methods and results of a group of analyses that compare how much a health investment or intervention costs with how much health value it produces. When used more broadly, health value or health benefit may be measured in many different types of units such as

reduced mortality, dollars saved, or increase in health utility. In the more specific sense, cost-effectiveness analysis is one of a variety of methods for assessing the cost-effectiveness of a treatment. Other methods in this group include cost-benefit analysis, cost-utility analysis, and cost-offset analysis. The identifying characteristic of cost-effectiveness analysis is that health value or benefit is measured in terms of clinical care units such as lives saved, amount of blood pressure reduced, or increased scores on a questionnaire.

Admittedly, this distinction between similar terms can be confusing. The following example is provided for further clarification. Suppose a group of researchers design an exercise-based intervention for people with chronic illness. Participants attend weekly exercise classes over the course of 1 year. The researchers measure a variety of variables (demographic, psychosocial, physiological, health-related quality of life [HRQOL], health care utilization, and mortality) before and after the intervention. The researchers also measure and/or estimate how much it costs to conduct the intervention. Suppose the intervention works well and the researchers find that participants in the intervention group have less pain, less depression, higher HRQOL, lower health care costs, slightly lower mortality, and more exercise-related injuries than the control group. In addition, one of the researchers' previously stated objectives was to measure the cost-effectiveness of the intervention. Here, the term is being used broadly, and does not specify the exact method the researcher would use. Since the researchers have measured a variety of outcome variables, they could do a cost-benefit analysis, cost-utility analysis, cost-offset analysis, and/or cost-effectiveness analysis. Any or all of these specific methods would provide a gauge of how cost-effective the intervention was in a general sense. If cost-effectiveness analysis was used, the remainder of this entry is relevant. First, I give a brief background of how and why cost-effectiveness became important in the field of health and behavior. Second, I provide more detail on terms and specific analysis methods, followed by a list of important parameters to consider when conducting or evaluating an analysis of cost-effectiveness. Finally, I provide a brief discussion and summary about how the results of cost-effectiveness analyses are used in health policy and how the field of behavioral health and medicine can use cost-effectiveness in the future.

## BACKGROUND

The cost of health care in the United States has increased dramatically in the last 30 years and continues to increase both in total dollar expenditures and as a percentage of gross national product. Although there was a temporary slowdown in the early 1990s, the rate of increase began to accelerate again within a few years. When compared with other countries, the United States spends far more on health care (as a percentage of gross domestic product) than any other country in the world. However, the high expenditures do not appear to translate into better health. Among 13 countries in one recent comparison, the United States ranked 12th when compared on 16 different indicators of health. Therefore, improving the overall health of the population while containing costs has become a major objective for both U.S. researchers and researchers in most industrialized nations.

The main problem facing any health care system is that health care resources (dollars for spending) are limited, yet there is an almost unlimited demand to spend more on new treatments or diagnostic procedures. Health care providers want to do everything they can to help each individual patient, and there are numerous treatment options, including new, expensive technologies, but someone must pay for all of them. Currently, this usually means that some type of health insurance or government agency pays for the treatment, although costs are passed on to everyone through premiums and taxes. Therefore, the administrators of these large organizations must decide what are the best treatments for the money. In theory, by maximizing the amount of health gained for each given dollar, or conversely, by minimizing the amount spent for a given unit of health benefit, society receives the most health for the least amount of money. One unfortunate but unavoidable result of this is that not everyone can have all the health care they desire, and the cost of some treatments are not reimbursable.

For example, imagine that the amount that can be spent on health care is fixed at \$100,000, and \$5,000 of each \$100,000 (5%) is devoted to behavioral services. If behavioral health professionals are able to convince health administrators that their services deserve \$8,000 of each \$100,000 spent, there will naturally be less to spend on other nonbehavioral health services. This is called the opportunity cost problem. Opportunity costs are the foregone opportunities that

**Table 1** Comparison of Cost-Effectiveness, Cost-Utility, Cost-Benefit, and Cost-Offset Analysis

<i>Type of Analysis</i>	<i>Compares</i>	<i>To</i>	<i>Comments</i>
Cost-offset	\$ value of resources used	\$ value of costs reduced by the intervention, usually health care costs	Focuses on saving money instead of health improvement
Cost-benefit	\$ value of resources used	\$ value of all resources saved or created, including health and longer life	Places monetary value on health and lives
Cost-effectiveness	\$ value of resources used	Health effects: illness specific, limited in scope (blood pressure, mortality)	Not comprehensive Difficult to compare across diseases
Cost-utility	\$ value of resources used	Health effects: preference-based (health-related quality of life, QALYs).	Comprehensive Allows for comparisons across all groups studied

are relinquished when resources are used to pay for a particular decision or treatment. If a lot of money is spent on pharmacological services, for example, less money is available to be spent on other services such as preventive or behavioral services.

When confronted with the choice between two good programs, it is always tempting to support both, despite the increased costs, and this option has been used quite often in the past. However, now that health care costs have almost doubled in the last 30 years, employees and employers do not want their fees for health insurance to rise anymore and taxpayers do not want tax increases.

How do we decide which services should get more and which should get fewer resources? By examining the ratio of what treatment costs to how much health it provides and then comparing this ratio to that of other treatment options. As mentioned above, there are a number of different methodologies for doing this. These methodologies are described in detail in the following section in an attempt to remove ambiguities arising from their incorrect and/or interchangeable usages.

## TYPES OF COST-EFFECTIVENESS ANALYSIS

The terms *cost-offset*, *cost-benefit*, *cost-effectiveness*, and *cost-utility* are often used inconsistently in the health care literature. This is primarily because the methodologies are relatively new and have undergone changes and improvements with time. These terms may be used to describe a type of analysis, as in conducting a “cost-utility analysis,” or they may describe

a value or ratio such as a “cost-benefit ratio.” The key concepts are summarized in Table 1.

Some interventions claim that their results show a *cost-offset*. Cost-offset is a term used to describe interventions that save money independent of their health benefits. Most often, this savings is related to reduced health care utilization and health care costs. This approach measures both program costs and treatment outcomes in dollar units. For example, treatment outcomes may be evaluated in relation to changes in the use of medical services or the economic productivity of patients. Treatments produce a cost-offset if the economic return exceeds treatment costs. Patients with heart disease who are aggressively treated with surgery, for example, may need fewer emergency medical services and less medications. The savings associated with decreased services might exceed treatment costs. Sometimes investment in a service can save money. For example, investment in a behavioral psychotherapy program may reduce overall use of health services (Spiegel, 1999). The overall expense for those paying for health services is improved because there has been a cost-offset. A cost-offset may be present within cost-benefit or cost-effectiveness analyses but often shifts the focus away from whether the intervention improves health. Therefore, cost-offset is not recommended as the primary goal of intervention development.

Cost-benefit analysis is similar to cost-offset analysis in that both methods compare the cost of a treatment in dollars to the resulting outcomes in dollars. However, a requirement of cost-benefit analysis is that all outcomes have a dollar value attached. Therefore,

side effects of a medication or functional benefits from a surgery must have a dollar value placed on them. The health improvements and/or reductions in health must be evaluated in terms of a dollar figure. This poses a variety of problems, since many people are uncomfortable placing monetary values on human life. In addition, the requirement that health care treatments reduce costs may be unrealistic. Health consumers are willing to pay for better health just like they are willing to pay for other consumer goods and services. Health problems are not treated in order to save money. In fact, not treating patients at all is probably the least expensive approach. Treatments are given in order to achieve better health outcomes. Therefore, treatments should be evaluated in terms of their effectiveness, not just their financial outcomes. The methodologies used to accomplish this are cost-effectiveness analysis and cost-utility analysis.

Traditional cost-effectiveness analysis compares the cost of an intervention or treatment (the numerator) to how much health improves (the denominator) as a result of the intervention or treatment. In the past, the health improvement usually focused on one outcome or measure of health such as blood pressure, depression score, smokers who quit, or mortality. The result of the cost-effectiveness analysis was stated as a ratio of dollars per outcome achieved. A behavior-based smoking cessation program could state that it cost a certain amount for each smoker who quit smoking, and this could then be compared with other smoking cessation programs. However, there were two main problems with this methodology. First, side effects, whether they be positive or negative, were either not measured, or if measured, were not included in the cost-effectiveness results. When comparing the behavioral-based smoking cessation program with a medication-based smoking cessation program, there may be various side effects related to each intervention that are never measured. The medication may produce severe headaches and nausea, while the behavioral program results in some additional health benefit not associated with cessation. Neither the positive nor negative side effect of the intervention would be represented in the analysis.

Second, the cost-effectiveness of the program could not be directly compared to programs that targeted health issues besides smoking. This is a problem because health care administrators often can only fund a limited number of programs at a time because of budget constraints and have to choose between two or

more programs that target different health problems. For example, should the limited amount of money available be used to support tobacco cessation programs for all enrollees or should it be devoted to inpatient care for a few individuals? For a similar cost, the programs may achieve a large effect for a few people versus a smaller effect for a large number of people. In summary, the treatment-specific outcomes used in cost-effectiveness studies do not allow direct comparisons across different health conditions.

These two problems with cost-effectiveness analysis led to the concept of measuring health-related quality of life (HRQOL) and cost-utility approaches. Therefore, cost-utility analysis can be considered an improved subtype of cost-effectiveness analysis. It still expresses the results in terms of dollars per unit of health benefit, but improves upon older methodology by expressing the health benefits in a comprehensive manner and in units that can be used across all diseases or health states.

This could lead some to ask, What units are relevant to all health states? Cost-utility approaches use the preference or utility of a health state or treatment effect as the unit of outcome. Therefore, a large, representative sample of a population assigns values, preferences, or utilities to various health states that range from death to perfect health, and the average preference or utility of the sample is calculated for each measurable health state. These utility or preference weights can be multiplied by time spent in that state to calculate a quality adjusted life year or QALY (Kaplan & Bush, 1982). QALYs are the comprehensive, common unit that can be calculated for all health states and used in cost-utility analysis. Mortality is also included in these analyses, since death is assigned a utility score of zero. Perfect health, or a health state in which a person has optimal functioning and reports no health symptoms, is assigned a utility score of 1.0. All other health states are typically rated on a scale that ranges from 0 to 1.0. Many people believe there are health states worse than death, and have proposed negative utility scores, which are beyond the scope of this entry.

Thus, QALYs can be calculated as change in health utility scores over time multiplied by the preference or utility score from a utility-based quality of life measure. QALYs can be assessed using a number of validated questionnaires such as EuroQol 5D, the Health Utilities Index, and the Quality of Well-Being (QWB) Scale. Quality of life measures such as the SF-36, or

PedsQL (for children), are more descriptive quality of life measures from which utility or preference scores cannot be directly calculated. For example, if a self-management intervention for people with chronic illness found that the mean QWB score for the intervention group increases from 0.650 at baseline to 0.750 after 1 year of the intervention, and that the mean QWB score for the control group stayed at 0.650 for the year, there would be an increase of 0.10 QALY for the intervention group. Next, if the intervention had an average cost of \$500 per participant, the cost-utility ratio would be  $\$500/0.010 \text{ QALYs} = \$5,000/\text{QALY}$ .

### IMPORTANT CONSIDERATIONS FOR CONDUCTING COST-EFFECTIVENESS ANALYSIS

As with many fields of research, cost-effectiveness analysis has evolved over time, and a variety of methods, approaches, and terminology have proliferated. Scientific advances were promoted by some and opposed by others, resulting in difficulty when comparing results derived from different methods. Because of the heterogeneity of methodologies, in 1993 the federal government appointed the Panel on Cost-Effectiveness in Health and Medicine to develop recommendations for consistent practice of cost-effectiveness analysis. The goal was to create common standards that researchers from all health disciplines could implement and understand. The findings of the panel were published as a book (Gold, 1996) and in a series of papers (Russell, Gold, Siegel, Daniels, & Weinstein, 1996; Siegel, Weinstein, Russell, & Gold, 1996; Weinstein, Siegel, Gold, Kamlet, & Russell, 1996). In the following sections, important elements of good cost-effectiveness analyses as defined by the panel are briefly reviewed.

#### Perspective

Each cost-effectiveness analysis is conducted from a specific perspective, which should be clearly stated. An *individual* perspective considers only the costs and benefits of a program for an individual citizen or patient. An *administrative* perspective evaluates cost-effectiveness as it pertains to a specific organization or agency. From the *societal* perspective, all health benefits and associated costs are considered, regardless of who experiences them or pays for them. Results may differ dramatically as a function of perspective.

A health insurance company, for example, might save money by not covering certain interventions. Costs may be reduced from an administrative perspective, but from a societal perspective, costs could remain unchanged or even increase because other agencies would end up paying for this service or for the consequences of conditions being left untreated. The Panel on Cost-Effectiveness recommended using the societal perspective because they believed that fair decisions must take all parties into consideration. In addition, the societal perspective attempts to measure all possible impacts of an intervention, both positive and negative, making it the most complete and informative.

#### Effectiveness Measures

In the past, and as discussed above, cost-effectiveness analysis relied upon calculating how much it cost to produce a prespecified change in some disease-related health indicator such as blood pressure, weight loss, and lives saved. The need for more comprehensive measures of health that could be expressed in a common unit of measurement led to the development of the concept of QALYs and cost-utility analysis. The Panel on Cost-Effectiveness studied different options and recommended that all studies of cost-effectiveness measure and report outcomes in \$/QALY if possible. Hence, all effects of a treatment or intervention, whether they are physical, psychological, or behavioral, are measured and translated into one score and one ratio that can be compared across many diseases and populations.

#### Accounting for Costs

When studying cost-effectiveness from the societal perspective, as is recommended, it is important to consider all resources directly required for the intervention as well as any indirect costs that result. Side effects may arise from the treatment, which require additional resources to treat. Some other indirect costs include the value of the time spent in the intervention for participants, travel expenses for participants, impacts on family members or caregivers of the participants, and changes in productivity due to disability or premature death. Some of these costs may be captured as part of the comprehensive measurement of QALYs, but those that are not should be added into the numerator or cost side of the cost-utility ratio (\$/QALY).

## Discounting Costs and Outcomes

Empirical evidence suggests that future benefits are worth more in the present and that future costs are worth less in the present. For example, most people would choose to receive \$100 today versus \$100 1 year from today because they have an extra year to either invest that money or spend it on things they can enjoy sooner. Economic theory assumes that health is a commodity like money and that people prefer good health sooner and worse health later. To account for this principle, future health (like costs) is discounted. Although there is still debate about discount rates and whether health is valued in the same way as money, the Panel on Cost-Effectiveness concluded that for the purposes of standardization, health outcomes should be discounted at the same rate as monetary costs. They recommend a discount rate of 3% per year.

## Comparators

Calculating a cost-effectiveness ratio for an individual program by itself does not say much. The results of a cost-effectiveness analysis should be compared to that of an alternative intervention or program, such as a control group, or different intervention and the difference between the two ratios reported. A *comparator* is the alternative to which a new treatment is compared. The cost-effectiveness panel recommended that new treatments should be compared to the best alternative that would typically be used if the new treatment was not available. Often, the best available treatment is what is currently being done. Many studies compare the cost-effectiveness for the treatment only in comparison with the control group. The problem with this approach is that if a new treatment were not available, patients might seek an alternative treatment or remedy. Therefore, a no-cost control group may not be the best comparator.

## Time Horizon and Modeling

A time horizon refers to how long after the intervention costs and outcomes are assessed. In general, the longer that follow-up assessment continues, the better, since there is always the possibility for side effects or benefits in the future. However, it is impractical and costly to try to measure these variables indefinitely. This problem gave rise to the development of a more recent technique for extending the time horizon of a cost-effectiveness analysis by modeling or

estimating future outcomes. Computerized modeling techniques use estimates of the probability of the possible health outcomes to calculate the health consequences as well as the future costs of the intervention.

## Sensitivity Analysis

Sensitivity analysis is a statistical technique that is important for producing a high-quality evaluation of cost-effectiveness. Because almost every analysis of cost-effectiveness must estimate certain aspects of costs or rates of outcome, uncertainty remains based on estimated values. Sensitivity analysis explores how the results of the analysis would change if the estimates were varied between a realistic upper and lower bound. Therefore, studies should report how sensitive their results are to the estimates contained in their analysis.

## Cost-Effectiveness, Public Policy, and Other Issues

Now that the terminology and key methodological components of high-quality cost-effectiveness studies have been explained, it is important to consider how this information will be used. In general, health care administrators in private industry and in government must decide what treatments will be covered by insurance and what treatments will not. They must also decide whether to fund existing or new programs that promote health or prevent illness. Although individual health care consumers or providers can become outraged when their own health procedure is not covered, the reality is that health care costs would grow uncontrollably if every possible treatment and public health program were funded. Health care costs would increase dramatically for everyone since a large majority of U.S. health care is paid for by insurance premiums or government health programs (taxes).

Therefore, policymakers have the unenviable task of comparing many different health treatments and deciding whether they should be covered or funded. The reason for using the results of cost-effectiveness analyses is to provide an objective method to assess how to obtain the most health for society as a whole, given a limited budget. It is true that this is not the only factor driving these decisions. Surgeries that can save a life are not discontinued because they are relatively expensive when compared to a new behavioral prevention program. Instead, the cost-effectiveness methodologies are simply one important component of these policy decisions.

In behavioral health, cost-effectiveness methodologies have been underutilized when compared with medical research (Kaplan & Groessl, 2002). Even though a greater number of high-quality cost-effectiveness analyses are being conducted in behavioral health and medicine since the Panel on Cost-Effectiveness published their recommendations, considerable challenge remains for behavioral health researchers to adopt these new recommendations and demonstrate that behavioral interventions are cost effective and worth adopting. Additional reading on the subject of cost-effectiveness can be found in the readings below and literature cited within them.

—Erik Groessl

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## CROWDING AND HEALTH

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The idea that close living quarters facilitates the spread of disease has long held sway in popular

opinion and among public health officials. There are at least two reasons to suspect why crowding might play a role in physical health. First, the probability of contamination from infectious diseases is higher when people are in close physical proximity to other individuals. Second, considerable evidence indicates that crowding is a stressor (Evans & Cohen, 1987; Evans, 2001) and thus might suppress immune function. Several important psychosocial processes, including negative affect and conflict, social support, and self-efficacy, are influenced by crowding. Thus, there are good reasons to suspect that crowding may also elevate risk for psychological distress. Below we discuss the measurement of crowding and evidence for physical and mental health sequelae.

### MEASUREMENT

How crowding is measured makes a difference in determining its health impacts. External indices of density such as people per census tract or people per square mile have little or no impact on human health. The salient experience of crowding is indoors, where people's activities are interfered with by the close presence of others (Stokols, 1972) and when crowding makes it difficult to regulate social interaction (Altman, 1975). Thus, indices such as number of people per room and to a lesser extent people per square meter are better metrics for the assessment of crowding health effects. People per room is the most sensitive index, probably because it best captures the underlying processes of behavioral constraint and unregulated social interaction that appear to convey the harmful impacts of crowding upon human beings.

### CROWDING AND PHYSICAL HEALTH

General population studies reveal mixed results when investigating associations between density and morbidity. Closer examination shows that among captive populations (e.g., schools, prisons, military, refugee camps), more consistent, although modest, associations are uncovered (Cox, Paulus, McCain, & Karlovac, 1982; Evans, 2001). Unfortunately, many population health studies are fraught with methodological and statistical difficulties. Some problems lead to potential overestimation of health effects such as reliance on cross-sectional designs, often without statistical controls for socioeconomic status. Other limitations can lead to underestimation bias. For



example, many studies use samples with restricted variance in residential crowding levels. Furthermore, we have little dose response data on crowding and health, and no human studies have examined immunological function and morbidity in the same sample. On the other hand, there are a few longitudinal replications of cross-sectional crowding-health associations, and some investigators have compared infectious to noninfectious disease rates and shown that only the former are related to crowding. There is also converging evidence from several crowding studies of institutional infirmity visits data with self-reports of physical symptoms.

Underlying physiological processes with documented links to physical morbidity are affected by crowding. Both laboratory and field studies reveal small but consistent elevations in psychophysiological parameters (e.g., skin conductance, blood pressure, catecholamines, cortisol) indicative of stress (Evans, 2001). Animal models suggest that some of these neuroendocrine changes also diminish fertility, providing a natural population regulation feedback mechanism. Efforts to uncover a human analogue have proven unsuccessful.

## CROWDING AND MENTAL HEALTH

Epidemiological evidence for crowding as a risk factor for mental illness is weak. Results are mixed, nearly all are cross-sectional, and some studies have inadequate controls for SES. Many crowding and mental health studies examine external density (e.g., people per census tract) rather than interior measures of density, and several rely upon relatively insensitive indices of mental health (e.g., psychiatric admission rates) (Gove & Hughes, 1983). Studies examining residential density and less catastrophic outcomes such as symptoms of anxiety and depression provide a more consistent pattern of evidence, although most are cross-sectional in design (Evans, 2001). Lepore, Evans, & Schneider (1991) are noteworthy in showing prospective evidence for an association between people per room and a standardized index of psychological distress.

Several psychosocial processes with well-documented mental health implications have been directly linked to residential crowding. These include experiences of negative affect or mood, interpersonal conflict, social withdrawal and diminished social support, and diminished feelings of self-efficacy or mastery

(Baum & Paulus, 1987; Evans, 2001; Gove & Hughes, 1983).

Both laboratory experiments and community studies consistently find links between crowding and negative affect or mood (Baum & Paulus, 1987; Evans & Cohen, 1987). Parent-child conflict is elevated in crowded households, and overt aggression may occur under certain circumstances. As one example, crowded nursery school children manifest more conflict when inadequate supplies of toys are available (Rohe & Patterson, 1974; Smith & Connolly, 1977).

Two programs of research have uncovered evidence that crowding leads to the deterioration of social support, which in turn elevates psychological distress. Baum and his colleagues in a series of studies in college dormitories have found that more crowded students are more socially withdrawn as evidenced by multiple indicators (Baum, Gatchel, Aiello, & Thompson, 1981). In several of these studies, students were randomly assigned to resident halls. Evans and Lepore have found both cross-sectionally and prospectively that residents of higher density homes have greater psychological distress that is mediated by diminished social support (Evans, 2001). People in crowded living environments appear to cope with too much unwanted social interaction by avoiding social contact. Unfortunately, an unintended side effect of this coping process is impaired social support, which in turn leads to heightened psychological distress. High-density living environments are evaluated as interfering with behavioral options and are associated with both self-report and overt behavioral evidence of diminished control beliefs. The latter includes laboratory and field evidence that persons in more crowded environments have deficits in motivation in achievement situations, such as working on a challenging puzzle (Baum & Paulus, 1987; Evans, 2001).

## SUMMARY AND CONCLUSION

Crowded interior living conditions are associated with infectious diseases among institutionalized populations. Crowding data for the general population do not support a clear link with physical morbidity. Both laboratory and field studies show elevated psychophysiological stress in relation to more crowded conditions. Social withdrawal and social support, beliefs that one has a sense of control over the environment, and under certain circumstances, conflict and aggression, are all impacted by crowding. Mental

illness is probably not affected by crowding, but psychological distress appears to be elevated by high-density interior living conditions.

Future research priorities on crowding and health include prospective, longitudinal studies, preferably with dose response data, that incorporate both underlying physiological processes (e.g., immune functioning) and physical morbidity. Parallel research is needed for psychosocial processes and psychological health outcomes.

—Gary W. Evans and Maria  
Gabriela Pereira

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## CULTURAL FACTORS AND HEALTH

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Education and socioeconomic status account for a significant portion of health disparities, yet there is much that is unexplained. Study of the culturally encoded protective and risk factors in health may improve our understanding. Culture is broadly defined as a set of guidelines regarding values, beliefs and attitudes, social roles, emotions, and behaviors for living. Culture may exact direct (e.g., limited English proficiency decreases health access) and indirect (e.g., self-efficacy as modifying or mediating preventive behaviors or adherence) effects upon health. The influence of cultural factors has been documented for coronary heart disease, cancer prevention, pain, mental health, suicidal behavior, health cognitions and behavior, emotions, health communication, help-seeking, and health decision-making strategies.

### ACCULTURATION, COMMUNICATION, AND LANGUAGE

The study of cultural factors in health is difficult because it is a moving target, undergoing continual change (across individuals, families, and through historical time) by socialization, acculturation, and social stratification (e.g., age, gender, or social class). In order to maximize health, people must retain healthy lifestyle practices from the culture of origin (plant-based diet with few processed foods) and adopt healthy lifestyle practices from the new cultural environment (health screening and preventive behaviors).

Language is a very basic aspect of culture. Having limited proficiency in using the language of the adopted country hinders health access, creates health professional/patient miscommunication, and decreases efficacy of English-only health promotion strategies, and leads to health disparities. We are only beginning to understand the influence of culture in health communications (visual-explicit levels to the implicit, emotional, and symbolic meanings). Cultural factors influence learning processes, cognitive information processing, and motivational strategies, especially

when new healthy lifestyles must be learned to replace unhealthy lifestyles.

## PERCEPTIONS OF HEALTH AND ILLNESS

There are differences in how cultures view the human body (optimal shape, size, construction, how it functions, boundaries), their prescriptions for health maintenance, perceived causes and resulting treatment of bothersome health conditions, and maintenance of well-being. Many cultures around the world have a more holistic view of health and wellness—an integration of the mind, body, and spirit. Western medicine (biomedical model of health) takes into account principles of physiology, anatomy, and biochemistry. People who view health more holistically express greater dissatisfaction with the quality of health care within a biomedical model of care. The congruence between culturally based lay models and medical models of health and illness have implications for health care and satisfaction.

The most globally held lay concept of health is the humoral theory, with roots in ancient China and India, elaborated by Hippocrates but abandoned by Western medicine. Under this belief system, health is achieved when the four humors (i.e., blood, phlegm, yellow and black bile) are balanced; ill health comes from an imbalance of these humors. Health interventions to regain balance come from food, herbs, medicine, spiritual or divine, social or environmental sources. Even in the context of strong cultural health beliefs, culturally responsive health education has been effective in promoting healthy behaviors (e.g., health screening, physical activities, nutrition), at least on a short-term basis. Long-term maintenance of healthy behaviors is a struggle for most people but may be more difficult if they are foreign to one's cultural beliefs.

## PERSONALITY, STRESS, AND COPING

Cultural syndromes are organized themes around shared attitudes, values, beliefs, norms, social roles, and self-definitions. There are four attributes that define individualism-collectivism (Triandis, 1996): (1) meaning of the self as independent (individualistic) versus interdependent (collectivistic), (2) structure of goals as priority to in-group goals (collectivistic) versus personal goals (individualistic), (3) behavior as a function of norms (collectivistic) versus attitudes (individualistic), and (4) focus on in-group needs

(collectivistic) or social exchanges (individualistic). Differential health outcomes have been associated with individualistic societies, higher smoking and cardiovascular heart disease, higher suicide, and psychological well-being rates when compared to collectivistic cultures.

Self-efficacy (e.g., internal locus of control, John Henryism, active coping) is a belief in one's own ability to effectively influence outcomes and is related to greater health promotion involvement, utilization of health screening, and better blood pressure control. In collectivist cultures, powerful others (family, friends, or health professionals) have a more prominent role in influencing health outcomes.

Cultural groups have different clusterings of stress symptoms and protective factors such as family cohesion, and hold different worldviews about the role of human suffering that may buffer or moderate the negative effects of stress. Cultures typically provide scripts and strategies such as meditation or mobilizing of social support networks to deal with life's miseries. Strong cultural beliefs may have negative implications for health such as difficulty in coping with a new culture and adoption of smoking or drinking to relieve stress.

## HELP-SEEKING BEHAVIORS AND HEALTH DECISION MAKING

Culture shapes the *who* (self, faith healer, medical doctor), *what* (influenza, germs, spiritual possession, curse), *when* (tomorrow, next week, month, or when other family needs have been met first), *where* (at home, community, doctors office or emergency room) of health, and *how* of help seeking, expectations for health care, and health decision making. For instance, a diagnosis of cancer may mean "immediate and certain death." Fears and anxiety regarding cancer have been associated with low clinical breast and Pap tests among minority women. Embarrassment may result during breast or Pap screening performed by male health professionals because of culturally based gender role expectations among older Asian immigrant women. Asians and Hispanics view Western medicines as very potent. They are cautious about their side effects and may decrease the dosage or abruptly stop taking the medication when they feel better. When patients ascribe high authority to healers (e.g., medicine man or medical doctor), suggestions by that healer to engage in health promotion behaviors may

have more influence in encouraging that behavior. Social support and social ties are predictive of mammography use in African Americans. In other words, cultural characteristics can be used to encourage health promotion and decrease health-damaging behaviors.

In summary, culture shapes how people view health and illness, influences how people feel about their health and how people will deal with life's stressors, and guides their help-seeking behaviors and health decision-making strategies. Cultural factors have been found to influence many aspects of health.

—Barbara Yee (AKA Bobbie)

*See also* ACCULTURATION AND HEALTH; AFRICAN AMERICAN HEALTH AND BEHAVIOR; ASIAN AMERICAN/PACIFIC ISLANDER HEALTH AND BEHAVIOR; COMPLEMENTARY AND ALTERNATIVE MEDICINE; CULTURAL FACTORS AND HEALTH; HEALTH DISPARITIES; IMMIGRANT POPULATIONS AND HEALTH; LATINO HEALTH AND BEHAVIOR; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; STRESS, APPRAISAL, AND COPING

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## DEPRESSION: MEASUREMENT

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The measurement of depression is dependent upon the thoughts, feelings, and behaviors that are assumed to define this disorder (Beck, 1967). Consequently, the various instruments that have been developed to screen people in general for depression or measure the severity of depression in patients who have already been diagnosed with psychiatric disorders may stress different behavioral signs and self-reported symptoms. For example, the Beck Depression Inventory FastScreen for Medical Settings (Beck, Steer, & Brown, 2000) and the Geriatric Depression Scale (GDS; Yesavage, Brink, Rose, Lum, Huang et al., 1983) do not contain any somatic symptoms of depression, such as loss of appetite, that might be attributable to medical problems.

Most scales of depression are internally consistent, yield scores that are moderately stable over time, and are positively associated with other measures of depression (for comprehensive reviews of specific scales, see Beckham & Leber, 1995; Marsella, Hirschfeld, & Katz, 1987; Reynolds, 1994; Sartorius & Ban, 1986; Yonkers & Samson, 2000). However, measures of depression have also been repeatedly found to be related to other measures of psychopathology, such as anxiety scales (Clark & Watson, 1991), and approximately 50% of what is being measured by a depression scale may represent general symptom distress or negative affectivity (Steer, Clark, Beck, & Ranieri, 1999).

There are two basic types of measures of depression: (1) clinical rating scales, such as the

Hamilton Psychiatric Rating Scale for Depression (HRSD; Hamilton, 1960), the Montgomery-Asberg Depression Rating Scale (Montgomery & Asberg, 1979), which was derived from the HRSD, and the Three-Area Severity of Depression Scale (Raskin, 1988), which permit a clinician to rate observable behavioral signs of depression, such as psychomotor retardation, and (2) self-report instruments, such as the amended Beck Depression Inventory (Beck & Steer, 1993), the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), and the Zung Self-Rating Depression Scale (SDS; Zung, 1965), which rely upon a respondent's awareness and willingness to describe symptoms. Although clinical rating scales and self-report instruments may stress different aspects of depression (e.g., the HRSD contains more somatic symptoms than does the BDI), both types of scales can usually be scored for subscales that permit comparing a person's cognitive, affective, and somatic aspects of depression with one another.

Some depression scales, such as the GDS, are composed of questions for which yes or no answers are requested, whereas other scales, such as the CES-D, ask respondents to describe how frequently each item in a list of symptoms has occurred using a rating scale that might range from *Never* to *All of the Time*. In contrast, the BDI, which is the most widely used instrument for measuring the severity of depression in adolescents and adults (Piotrowski, 1996), requests that respondents (a) read groups of statements about a specific symptom that are listed in terms of increasing severity and then (b) select the one statement in each group that best describes how they have been feeling.

The lengths of time upon which the ratings are based may also vary. One instrument might question about feelings for the past month, whereas another scale might inquire about present feelings. The former instrument is measuring depression as an enduring trait, whereas the latter instrument is evaluating depression as a transient state or mood.

There are a variety of measures that now address the symptom criteria for depressive disorders that are listed in the *Diagnostic and Statistical Manual of Mental Disorders*. For example, the clinical rating and self-report scales in the Inventory of Depressive Symptomatology (Rush, Giles, Schlesser, & Fulton, 1985), the Hamilton Depression Scale (Reynolds & Kobak, 1995), which is a self-report version of the HRSD, the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996), which is the upgraded version of the amended BDI, and the Depression Inventory for Youth (Beck, Beck, & Jolly, 2001) specifically address symptoms corresponding to *DSM-III-R/DSM-IV* depressive disorders. However, several widely used instruments, such as the Children's Depression Inventory (CDI; Kovacs, 1992), the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983), and the Reynolds Adolescent Depression Scale (Reynolds, 1987), were not constructed to assess symptoms representing specific depressive disorders, and include symptoms, such as anxiety, that are associated with depression.

The HRSD, the BDI, the CES-D, the CDI, and the GDS have both short and long versions, and the symptoms listed in the HRSD and the BDI have changed over the years. The original version of the BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) was only slightly rewritten to become the amended BDI. However, the amended BDI was substantially changed when it was upgraded to the BDI-II by adding several new symptoms and deleting several old symptoms from the original version. The original version of the HRSD had 17 items (Hamilton, 1960), whereas one of the most widely used versions of the HRSD contains 24 items (Guy, 1976). Unfortunately, it is sometimes difficult to ascertain which version of an instrument has been used, because only the original reference for an instrument has been cited, instead of the version that was actually employed.

Finally, many instruments assessing a broad spectrum of mental health symptoms contain scales of depression, such as the Multiple Affect Adjective Check List—Revised (Zuckerman & Lubin, 1998),

the Minnesota Multiphasic Personality Inventory-2 (Hathaway & McKinley, 1989), and the Symptom Check List-90-R (Derogatis, 1983). However, none of these measures of depression can be used by itself to diagnose clinical depression. A detailed structured clinical interview, such as that provided by the Structured Clinical Interview for *DSM-IV* (First, Spitzer, Gibbon, & Williams, 1996) or the Children's Interview for Psychiatric Syndromes (Weller, Weller, Rooney, & Fristad, 1999), is required to establish whether a person's symptoms meet criteria for a specific depressive disorder.

—Robert A. Steer and Aaron T. Beck

See also DEPRESSION: MORTALITY AND OTHER ADVERSE OUTCOMES; DEPRESSION: TREATMENT; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY

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## DEPRESSION: MORTALITY AND OTHER ADVERSE OUTCOMES

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The association between depression and mortality has been well established in both clinical studies and studies of community samples of adults. In clinical samples, the lifetime risk of suicide has been estimated to be as high as 15% for persons with unipolar or bipolar depression (though some question the magnitude of this risk). In addition, depression is known to increase the risk for nonsuicide mortality, especially mortality secondary to cardiovascular disease. The mechanisms by which depression leads to an increased risk for nonsuicide mortality, however, have yet to be determined and probably involve multiple, independent feedback loops, such as the association of depression and functional disability over time. The association of depression with suicide, nonsuicide mortality, and functional status are reviewed below.

## DEPRESSION AND SUICIDE

Suicide is the eighth leading cause of death in the United States, although the overall rate of between 11 and 12 per 100,000 annually has not changed appreciably over the past few decades. White males over the age of 65 as well as persons who live alone and are in poor health are at greater risk for suicide. The frequency for White males over 65 years of age is 62 per 100,000 per year. A history of depression can be identified in 50% to 75% of cases of suicide. The period of greatest risk occurs within 3 months of the onset of a depressive episode and within 5 years of the onset of a lifetime history of a major depressive disorder.

## NONSUICIDE MORTALITY

The association of depression and nonsuicide mortality has been extensively studied in both community and clinical samples. The relative risk for depression as a predictor of nonsuicide mortality varies from one (meaning no risk) to four, but most studies find about a twofold increased risk. The effect appears to be stronger in men than in women. Rates across race do not appear to vary (as they do for suicide). The risk may be higher in clinical samples of psychiatric patients than community-based samples.

There are many potential causes of the increased risk for mortality among persons with depression. Persons with depression may not comply with recommendations for their health care, such as taking medications regularly. In addition, the depressed are more inclined to smoke and exhibit other lifestyle characteristics (such as poor diet) associated with an increased mortality risk. They may, due to their depressive symptoms, be less likely to maintain an adequate social support network (and impaired social support has clearly been associated with an increased risk of mortality). In addition, depression may contribute to an increased biological vulnerability to disease, especially cardiovascular disease. The stress of a depressive episode may trigger episodes of transient cardiac ischemia. Other mechanisms that have been proposed include decreased vagal tone secondary to hypothalamic pituitary adrenal axis abnormalities, which leads to decreased heart rate and alterations in platelet serotonin receptors that may promote plate clumping.

The evidence for an association in the elderly, however, remains inconclusive, especially in well-controlled studies. These inconclusive results, which

derive especially from community-based studies, are probably secondary to which variables are controlled and which are not. For example, if an investigator controls for functional impairment, the risk for mortality secondary to depression decreases (often approaching unity). Depression is known to lead to increased functional disability, and functional disability, in turn, leads to an increased mortality risk. Functional disability also increases the risk for depression. Therefore, functional disability becomes a key mediating factor in the association of depression and mortality. How one conceives the interaction of depression and functional status over time will usually determine whether or not variables such as functional status are considered true confounding variables in the study of the association of depression and mortality.

## DEPRESSION AND FUNCTIONAL STATUS

Depression increases the risk for functional disability, perhaps as much as any chronic medical disorder such as diabetes or cardiovascular disease. Among the clinically depressed, as many as 17% may be unable to work because of their depression. Even less severe (or minor) depression is associated with increased disability days and days lost from work. Depression has been most often studied as a risk for disability among the elderly, increasing the risk for disability over 6 years by nearly 70%. Physical disability, as noted above, can also lead to depression, creating a vicious downward spiral. Functional decline can lead to restriction of valued social and leisure activities, increased social isolation, and a reduction in the quality of social support. Among the oldest old, the interaction of depression and disability may lead to the serious syndrome of frailty and failure to thrive and ultimately to death.

In summary, depression is a significant risk factor for a decline in physical health and functional status. These declines, plus more direct pathways, render depression a risk for increased mortality. Depression also is a risk for mortality directly through the increased risk for suicide.

—Dan Blazer

*See also* DEPRESSION: MEASUREMENT; DEPRESSION: TREATMENT; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH



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## DEPRESSION: TREATMENT

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Clinical depression refers to a group of psychiatric disorders in which the primary symptoms are persistent depressed mood (either self-reported or observed by others) and/or markedly diminished interest/pleasure in activities most of the day, nearly every day, for at least a 2-week duration (American Psychiatric Association, 1994). These psychiatric disorders are comprised primarily of Major Depressive Disorder (MDD), single episode and recurrent, and Dysthymic Disorder (DD). Although MDD and DD can co-occur, DD represents a less severe but longer lasting disorder marked by persistent depressed mood. The majority of individuals (approximately 72%) who have had MDD tend to have recurrent episodes of depression (Kessler, Zhao, Blazer, & Swartz, 1997).

To be diagnosed with MDD, the patient must have a number of psychological and physiological symptoms that represent a change from previous levels of functioning, that lead to significant impairments in functioning, and that cannot be attributed to the direct effects of a chemical substance, medication, or an existing medical condition (American Psychiatric Association, 1994). A number of significant individual differences can be present in the manifestation of MDD that may have an effect on the severity and course of depression. Psychologically, MDD may, but does not necessarily, involve feelings of worthlessness, diminished ability to concentrate, and recurrent thoughts of death. Physically, the depressed individual may experience weight changes (either gain or loss), sleep disturbances (too much or too little), restlessness, or psychomotor retardation. The fact that the symptom constellation that accompanies MDD can differ between depressed individuals suggests the presence of multiple etiologies for this disorder.

Consistent with the diverse symptom presentations possible in MDD, a number of treatment approaches, both psychological and pharmacological, have been developed. The focus of this entry is on the primary psychological and biological interventions studied and found to be efficacious in clinical trials of treatments for MDD. Efficacy in many of these studies was defined as a reduction of symptoms from one treatment relative to the effects of an appropriate control/comparison treatment and/or a 50% reduction of symptoms as assessed by standardized measures relative to baseline. It is important to note that while many theories and hypotheses exist, the underlying mechanisms that cause depression remain to be established empirically. Although many of the treatments to be described have been shown to be effective in reducing the symptoms of depression, none of these treatments can be considered to be a cure for depression.

## PSYCHOLOGICAL TREATMENT APPROACHES

Three psychotherapeutic approaches, namely cognitive, behavioral, and interpersonal, have attracted much of the research attention in clinical studies of depression. Although a number of specific psychotherapies fall under each approach, Beck's cognitive psychotherapy (CT; Beck, 1967), Klerman's interpersonal psychotherapy (IPT; Klerman, Weissman, Rounsaville, & Chevron, 1984), and Lewinsohn's behavioral psychotherapy (BT; Lewinsohn, Youngren, & Grosscup, 1979) have been

most studied and found to be empirically validated as efficacious treatments for depression (Frank & Thase, 1999). While both psychotherapies apply a time-limited, present-focused approach, the focus of the therapy is distinctive with each approach, based on theories postulating different core issues underlying the development and maintenance of depression.

### Cognitive Psychotherapy

According to the theory proposed by Beck in 1967, individuals who have relatively stable negativistic concepts and attitudes about themselves, the world, and the future are predisposed to developing depression. These negativistic concepts are believed to have developed over time through experience and are an organized cognitive structure, referred to as a schema. Schema is the pattern in which the environmental stimuli are cognitively broken down and organized into psychologically meaningful information. The negativistic attitudes take the form of value judgments individuals habitually makes about themselves, the world, and the future. The negative attitudes and schema are reflected in the dysfunctional automatic thoughts that have become the habitual manner of thinking for the depressed individual. In the presence of stressor(s) or difficult life situations, the negativistic attitudes associated with a maladaptive cognitive schema ultimately lead to depressed mood.

The maladaptive cognitive schema, believed to be maintained by cognitive errors, is hypothesized to have an adverse effect on the depressed individual's interpretation of experience. Six types of cognitive errors, namely, (1) arbitrary inference, (2) selective abstraction, (3) overgeneralization, (4) magnification and minimization, (5) personalization, and (6) absolutistic, dichotomous thinking, have been specified from the CT perspective on how depressed individuals may misinterpret a life experience (Beck, Rush, Shaw, & Emery, 1979).

CT, from Beck's perspective (Beck et al., 1979), is a didactic process in which the therapist teaches the depressed client to identify, recognize, and monitor negativistic automatic thoughts and cognitive errors. To increase the client's awareness of these maladaptive thoughts, a frequently employed homework assignment is to keep a log of automatic thoughts that occur. Once the automatic thoughts are identified, the therapist may use "if-then" and "what-if" types of questions to delve deeper into the underlying meaning

that these thoughts have for the depressed client to infer the cognitive schema. For example, an individual who often thinks that he or she will not be able to successfully overcome a problem as an initial response to a challenging situation may hold a more general belief that he or she is not intelligent, even though such a perception is not accurate. Once identified, the client is taught to objectively examine the automatic thoughts to determine if there is a basis in reality for the thoughts and to challenge the validity of the automatic thoughts within a collaborative therapist-client relationship. As therapy progresses, similar methods would be employed to examine and challenge the cognitive schema, the core belief system believed to underlie the depression.

### Interpersonal Psychotherapy

In the interpersonal theory of depression proposed by Klerman and colleagues (1984), the precipitating factor associated with the onset and perpetuation of depression is social maladjustment. According to this theory, impaired caretaker-child bonding in early childhood predisposes an individual to the development of impaired interpersonal relationships, which can trigger and/or foster depression in adulthood.

The overall goals of IPT are to reduce symptoms of depression and the four interpersonal problem areas associated with the onset and perpetuation of depression. In this time-limited psychotherapy, the strategy in the initial sessions is to identify the depression symptoms and to associate the depression to interpersonal issues that may be responsible for the depression. The primary interpersonal difficulties to be addressed in therapy are categorized into four problem areas, namely unresolved grief, interpersonal disputes, role transitions, and interpersonal deficits. Unresolved grief is addressed by facilitating the mourning process and by reestablishing interest in the development of new relationships. In resolving interpersonal disputes, the focus is on the modification of nonreciprocal role expectations or faulty communication patterns. Problems involving role transitions are ameliorated by encouraging acceptance of role loss, fostering a positive view of the new role, and developing a sense of mastery over the requirements of the new role through methods such as social skills training. Interpersonal deficits center on social isolation and the need to develop new relationships.

To meet these goals, IPT incorporates an array of diverse psychotherapeutic techniques, including relatively less directive psychodynamic techniques such as encouragement of affective expression in addition to more active means such as decision analyses, aimed at encouraging the patient to delay impulsive action and to consider a number of possible ways to solve an interpersonal problem.

### Behavioral Therapy

Lewinsohn's behavioral therapy (BT) (Lewinsohn et al., 1979) is a treatment approach that has been found to be effective in the reduction of depression (Antonuccio, 1998). The theory behind BT posits that the occurrence of a stressful situational or environmental event (e.g., job loss or ongoing marital discord) precipitates the chain of events that lead to the onset and/or maintenance of depression. These stressful events are thought to lead to a disruption of established behavior patterns and a reduction of pleasant events and/or an elevation of aversive events that may be associated with depressed mood, behavioral withdrawal, and self-criticism. The primary goal of this therapy is to increase the frequency of pleasant events and to reduce aversive events by altering the individual's activities and social interactions. The strategies used in this psychotherapy (Lewinsohn & Arconad, 1981) include changing the environmental conditions (e.g., increasing rewarding activities), teaching skills to enhance interactions with the environment (e.g., social skills training), and enhancing the pleasantness or decreasing the aversion of interactions with the environment (e.g., relaxation training and cognitive self-management such as thought stopping).

### BIOLOGICAL TREATMENT APPROACHES

The most common biological treatment approach for MDD is pharmacotherapy, which has been shown to be an effective treatment in a number of clinical trials. A less frequently employed but effective biological treatment for depression is electroconvulsive therapy, a method that is usually reserved for severe cases that do not respond to other mainstream treatments.

The development of pharmacological treatments for depression began in the 1950s and in the years following with the discovery that a monoamine oxidase inhibitor and a tricyclic compound, which were originally developed as antituberculosis and antipsychotic

agents respectively, also had mood elevating effects. Following a series of agents that were variants of these antidepressants, a significant advance in the pharmacotherapy of depression came in the late 1980s into the 1990s with the development of a new class of agents known as selective serotonin reuptake inhibitors (SSRIs), which lacked many of the potentially fatal side effects present in the two existing classes. More recently, a diverse group of novel agents has been developed that has a relatively favorable side effect profile and has been shown to be at least as effective as existing antidepressant agents.

Most antidepressant pharmacological agents are known to affect the monoamine neurotransmitters, which include epinephrine, norepinephrine, dopamine, and/or serotonin (5-HT). Neurotransmitters are chemicals that travel across the connective junctions of cells (i.e., synaptic junctions), enabling cells to communicate with each other. It is believed that the therapeutic effect on depression is due to the effects of the pharmacological agent on these neurotransmitter systems.

### Monoamine Oxidase Inhibitors

Monoamine oxidase inhibitors (MAOIs) inhibit an enzyme, monoamine oxidase (MAO), found in the body as well as the brain, thereby increasing the availability of monoamine neurotransmitters. There are two known types of MAO enzymes (A and B). Type A MAO is relatively selective for the metabolism of 5-HT and norepinephrine, while Type B MAO is relatively selective for the metabolism of benzylamine and phenylethylamine.

The early MAOIs (e.g., phenelzine or Nardil and tranylcypromine or Parnate) were irreversible in the sense that the drug would bind to the MAO enzyme permanently and be nonselective in terms of binding to both types of MAO. These early MAOIs are not often prescribed at present due to potentially life-threatening side effects. A hypertensive crisis and possibly stroke can result from ingestion of food products containing relatively high levels of tyramine (e.g., cheeses). Potentially fatal drug interactions have been discovered among individuals taking early MAOIs along with stimulants, commonly used over-the-counter cold remedies, and other antidepressants. Other possible significant side effects of early MAOIs are weight gain, postural hypotension, sexual dysfunction, and hepatotoxicity, for which the original

MAOI, iproniazid, was withdrawn from use. Mortality from overdosing on early MAOIs has also been reported, raising concerns about prescribing this agent to severely depressed patients who may be at risk for suicide.

Many of these drawbacks of the early MAOIs were resolved with the relatively recent introduction of the reversible MAOIs (Lotufo-Neto, Trivedi, & Thase, 1999), such as moclobemide and brofaromine. Moclobemide is much less likely to produce a hypertensive crisis, as this drug is readily displaced from its binding site on the Type A MAO. This reversible MAOI has been found to be relatively safer in overdose situations and is not associated with orthostatic hypotension, although some common side effects include nausea, insomnia, tremor, and dizziness. Although this agent has been found to be more efficacious relative to placebo and as effective as tricyclic antidepressants and SSRIs (Lotufo-Neto et al., 1999), this agent is currently available only outside the United States.

### Tricyclic Antidepressants

The first tricyclic antidepressant (TCA), imipramine, was a tricyclic compound that was a structural variant of the antipsychotic agents known as the phenothiazines. The TCAs that followed imipramine include amitriptyline, clomipramine, desipramine, dothiepin, doxepin, lofepramine, and nortriptyline. Most TCAs are thought to block predominantly the reuptake of norepinephrine, although some agents (e.g., amitriptyline) also block the reuptake of serotonin and to a lesser degree dopamine.

The efficacy of TCAs has been well documented, and TCAs are often thought to be the most effective pharmacological agent for severe depression. A significant drawback to TCAs in general has been the potential for adverse cardiovascular effects of the drug. Postural hypotension, tachycardia, and arrhythmias have been found to occur with TCAs. Overdosing on TCAs has also been found to cause cardiac arrest. Other relatively common side effects include sedation, dry mouth, blurred vision, weight gain, and recent memory loss. Many of these side effects are associated with the anticholinergic effects, resulting from the inhibition of cholinergic neurotransmission at muscarinic receptor sites. TCAs vary in terms of the likelihood for anticholinergic effects; imipramine and amitriptyline are two of the more

highly anticholinergic TCAs. Despite these significant side effects, TCAs are considered to be the standard by which efficacy of other agents is compared.

### Selective Serotonin Reuptake Inhibitors

Unlike the TCAs, the selective serotonin reuptake inhibitors (SSRIs) are known to almost exclusively inhibit the reuptake of 5-hydroxytryptamine (5-HT), a neurotransmitter also known as serotonin, although the chemical structure of these antidepressants may differ. The inhibition of the reuptake of 5-HT following its release into the neural synapse increases the activity of serotonin in the central nervous system. Some of the most commonly prescribed drugs belonging to the class include citalopram (Celexa), fluoxetine (Prozac), fluvoxamine (Luvox), paroxetine (Paxil), and sertraline (Zoloft).

In recent years, the popularity of the SSRIs has increased dramatically, mostly due to a favorable side effect profile, increasing the likelihood that the patient will be tolerant of and adherent to this medication. The SSRIs do not require the type of dietary restrictions of MAOIs and do not have the cardiovascular side effects of TCAs. Unlike the SSRIs and the TCAs, overdose on SSRIs alone is rarely fatal, reducing the potential for lethality in depressed suicidal patients. Sexual dysfunction and headaches are common adverse effects of some SSRIs, however.

### Current Generation of Antidepressants

While the SSRIs yielded more favorable side effect profiles, the need to increase the efficacy and the onset of therapeutic effects of these agents, among other issues, remained. In general, most available antidepressants produce remission of depression in only a fraction of patients (30%), with partial response (40%) and no improvement (30%) being the majority outcome (Gumnick & Nemeroff, 2000). The latest antidepressant medications are the result of attempts to bring about improvements in these areas. These include dual serotonin-norepinephrine reuptake inhibitors such as venlafaxine (Effexor), potent 5-HT<sub>2</sub> receptor antagonists such as nefazodone (Serzone), tetracyclic antidepressants such as mirtazapine (Remeron), the norepinephrine reuptake inhibitor reboxetine (not available in the United States), and bupropion. These agents have been found to be as efficacious as TCAs, and some evidence suggests that

venlafaxine and reboxetine may be more efficacious compared to SSRIs for the treatment of severe depression (Gunnick & Nemeroff, 2000). A variety of side effects have been noted in these agents, with the arguably most significant ones being a dose-dependent blood pressure increase for venlafaxine, drug interactions with benzodiazepines for nefazodone, weight gain and sedation for mirtazapine, and increased seizure risk for bupropion.

### Other Biological Treatments

In electroconvulsive therapy (ECT), an electrical impulse is applied either unilaterally or bilaterally to an anesthetized patient's head in order to produce a generalized seizure of approximately 1 minute in duration. The frequency and duration of this treatment vary significantly, depending on patient-specific issues, although a typical regimen can involve two to three sessions per week for several weeks.

ECT is thought to be beneficial for individuals with treatment-resistant depression and very severe MDD (e.g., extreme agitation, highly suicidal, psychotic, and/or severe neurovegetative symptoms). This procedure may be contraindicated, however, in patients with cardiovascular disease (e.g., hypertension, recent myocardial infarction), cerebrovascular disease, respiratory illnesses, brain tumors, and conditions involving increased intracranial pressure. Confusion and memory loss are relatively common adverse effects, which can be accentuated in older patients and patients receiving concurrent lithium pharmacotherapy and/or bilateral ECT administration.

### EMPIRICAL COMPARISON OF PSYCHOLOGICAL AND BIOLOGICAL TREATMENTS

The National Institute of Mental Health (NIMH) Treatment of Depression Collaborative Research Program was the first large-scale randomized placebo-controlled study to directly compare the efficacy of two prominent psychotherapies, Beck's CT and Klerman's IPT, as well as to compare psychotherapy with the antidepressant medication imipramine, plus clinical management (TCA condition), for the treatment of depression in 250 patients over a 16-week treatment period. At termination of treatment, patients in all four conditions showed similar mean improvement in depressive symptoms

(Elkin et al., 1989). Primarily on the basis of analyses of recovery rates (scores below a cutoff on depression rating scales), however, the authors concluded that imipramine was most effective and that the evidence for efficacy was limited in IPT and not at all evident for CT, especially among the more severely depressed patients evaluated shortly after treatment termination.

The results of Elkin and colleagues about the ineffectiveness of CT were at odds with previous meta-analyses that suggested CT was more effective than other psychotherapies and pharmacotherapies available at the time (Dobson, 1989). Follow-up analyses of pooled data from four studies (including the NIMH study), using more rigorous criteria for selection of studies, found no conclusive evidence that CT was different in efficacy from imipramine among severely depressed outpatients (DeRubeis, Gelfand, Tang, & Simons, 1999). Moreover, in the NIMH study, recovery rates (8 weeks of minimal/no symptoms and no MDD relapse) assessed at 6-, 12-, and 18-month follow-up evaluations were similar across treatment groups (Shea et al., 1992). Taken together, these studies suggest that no differences in efficacy exist between these psychotherapies and that psychotherapy and TCAs are equally efficacious for the treatment of depression.

Studies comparing TCAs and SSRIs for the treatment of depression support the use of SSRIs, and SSRIs have become the first-line pharmacological agent of choice for the treatment of depression (Petersen et al., 2002). Meta-analyses of efficacy studies comparing SSRIs and TCAs have found no significant differences (e.g., Anderson, 2000). In terms of discontinuation of therapy due to side effects, however, significantly less dropouts have been associated with SSRIs relative to TCAs, with the exception of fluvoxamine, which was similar to the dropout levels found for TCAs (Anderson, 2000).

Some recent studies of dual action antidepressants (inhibitors of both 5-HT and norepinephrine reuptake, e.g., venlafaxine) have suggested that these agents may be more efficacious than SSRIs, particularly for severe depression, and better tolerated than TCAs (Tran, Bymaster, McNamara, & Potter, 2003). These findings are equivocal, however, as other studies have reported no significant differences, and further study on the efficacy of dual action agents is warranted.

A recent review of clinical trials of ECT suggests that it is an effective treatment for depression relative to placebo and that it may be more effective than drug

therapy (UK ECT Review Group, 2003). No evidence was found in this review to suggest that ECT may cause brain damage, as detractors have suggested, although few studies have examined this issue. This method is not usually considered a first-line treatment, however, given the highly invasive nature of this technique.

Since much of the evidence on established treatments for major depression suggests similar degrees of efficacy, the choice of first-line treatment, both between and within types of treatment, remains heavily dependent upon an evaluation of clinical issues between the patient and the clinician (e.g., Gumnick & Nemeroff, 2000). These issues can include but are not limited to patient preferences for one treatment over another, severity of the illness, relapse pattern, tolerance or presence of side effects, previous treatment history, and the presence of comorbid medical or psychiatric disorders. Several treatment guidelines have been published to date (Trivedi & Kleiber, 2001; see Further Reading) that generally follow the principle of starting with the least invasive procedures with the most favorable side effect profile first (e.g., SSRIs, psychotherapy) and moving toward more invasive procedures if the patient is nonresponsive.

—Steven J. Choi and Karina Davidson

See also DEPRESSION: MEASUREMENT; DEPRESSION: MORTALITY AND OTHER ADVERSE OUTCOMES; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY

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## DIABETES: BEHAVIORAL TREATMENT

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Diabetes mellitus (DM) is a disorder of metabolism manifested by hyperglycemia. Type 1 and Type 2 are the primary types of diabetes. Although different in etiology, both types exhibit a high degree of comorbidity with other disorders, primarily hypertension and dyslipidemia. Long-term complications include microvascular, macrovascular, and neurological damage. The etiology of Type 2 DM rests squarely on behavior, particularly overeating, lack of exercise, and poor food choices. Psychological stress exacerbates hyperglycemia in most persons with DM by mobilizing glycogen resources in the liver and increasing glucose in the bloodstream. Cell membranes resistant to insulin prevent entry of glucose into the cells.

Management of DM comprises hypoglycemic medication (insulin and/or oral agents), which must be taken daily, regular monitoring of blood glucose, controlled diet, exercise, and stress management. The first steps rely on structured education about self-care; self-care behaviors remain the cornerstone of therapy. Changing dietary choices, increasing exercise, and learning to manage stress each require special skills and determination, which are facilitated by adaptive coping and social support from family and friends.

## THE DM MANAGEMENT TEAM

The team consists of the physician, the nurse/diabetes educator, and the patient functioning in a collaborative model of care. Health care providers monitor glycemic control by reviewing self-reported blood glucose data and regular assessment of glycohemoglobin by biologic assay. Frequent monitoring and keeping records of blood glucose levels provides information necessary to determine what works and what needs changing; thus, the management plan can be adjusted based on accurate data. Home glucose monitoring machines help to make blood testing easier and more accurate for tailoring one's daily plan for exercise, stress, and work or school demands. Most helpful is working closely with diabetes experts—physicians (e.g., endocrinologists, diabetologists), nurses (certified diabetic educators), nutritionists (registered dietitians), and exercise physiologists—in a program designed to meet the complex needs of people with diabetes. The counselor expert in stress management is fast becoming an integral part of the team to handle issues related to psychological stress or clinical syndromes common to diabetes patients, such as anxiety and depression. When medical or psychiatric comorbidity is present, the management plan needs to include recommendations for therapy of related illnesses.

## PSYCHOLOGICAL PROBLEMS IN PERSONS WITH DM

Affective disorders are common in persons with DM. Meta-analyses have confirmed the association between depression and higher blood glucose, poorer self-care, and more frequent complications of DM. Even depressed mood below the level of clinical depression is related to poorer glycemic control. Therapy of mood disorder with antidepressant medication and cognitive-behavioral therapy tends to normalize the neurochemical and behavioral factors driving the increase in blood glucose. In addition, minimizing depression improves positive health practices. Anxiety, whether free-floating or specific worry about diabetes, is frequently seen in persons with DM. Pharmacological, psychotherapeutic, or psychophysiological therapies for therapy of anxiety are available and effective.

## Self-Care

Both healthy eating and exercise have powerful effects on keeping the blood glucose within a healthy

range, thus preventing or delaying complications. Recent studies show that healthy diet and exercise patterns can help to keep one's blood sugar levels at near-normal ranges, and prevent or minimize short-term and long-term complications. People with diabetes often say that the hardest part of their regimen is eating a healthy diet and exercising. To avoid feeling helpless about having diabetes, the patient can function within an empowerment perspective by participating in decisions about managing the disease. Providers of care need to promote patients' desires to be involved in their own healthcare and to suggest avenues to empower patients for those with submissive traits. Better glycemic control is associated with more knowledge of self and personal needs and less helplessness. Realistic goals can be set and revised together to enhance the likelihood of success. Results of healthy eating and exercise are (a) having energy and a sense of well-being to enjoy life, (b) achieving near-normal blood glucose levels, (c) maintaining near-normal body weight, (d) preventing acute and chronic complications of diabetes, and (e) lowering blood pressure and plasma lipids in persons with DM who also have hypertension and hyperlipidemia.

### *Diet*

In the past, people with diabetes had rigid diet prescriptions and were told not to eat too many carbohydrates (breads, starches) and never to eat sugared foods such as sodas and desserts. Current guidelines are no longer for a "diabetic diet," but instead call for eating a healthy diet tailored to individual food preferences. The American Diabetes Association (ADA) recommends that people with diabetes follow the U.S. Dietary Guidelines for all Americans: eat a variety of foods; monitor portion sizes; eat foods high in fiber (fruits, vegetables, and whole grains); and consume fat, sodium, and sugar in moderation. People with diabetes need to know approximately how many calories or servings to eat each day from the three nutrient categories: carbohydrates, proteins, and fats. Specific recommendations are the responsibility of the physician and dietician, and usually are as follows: (a) protein: 10% to 20% of total calories (depending on kidney function), (b) fat: no more than 30% of total calories, and (c) carbohydrates: 50% to 60% of total calories. Fiber intake should be about 20 to 35 grams per day to enhance proper absorption of foods

from the intestinal tract and to promote normal bowel function. Other guidelines from the ADA include dividing meals into three per day about 5 to 6 hours apart, with between-meal snacks as needed; adjusting exercise and insulin (or other diabetic medication) to fit the meal pattern and to maintain proper blood sugar levels. Other recommendations are to minimize sugar intake by using FDA-approved artificial sweeteners and to use alcohol in moderation while accounting for the calories of alcoholic beverages. Avoidance of saturated fats (such as those in red meat, cheese, and butter) is also advised.

### *Meal Planning*

No specific meal pattern is right for all people with diabetes. Meal patterns can be as varied and flexible as needed to find a way that works for each person. Meal plans should be developed working with a certified diabetic educator to arrive at a design that fits the individual and can be followed. As with all plans, they can change when circumstances require, for example, if a child is growing rapidly or if an adult becomes more (or less) active. Factors influencing meal plans include cultural eating patterns, individual food preferences, activity level, medication schedules, and whether cooking at home or eating out. The goal is to eat a balanced diet at regular, predictable times that fit with one's lifestyle.

Scientific knowledge frequently changes in areas of nutrition, making it hard to know what is best. Although many fad diets are advertised to the public, people with diabetes should avoid fad diets that may be dangerous to their health. For example, the high protein diet sometimes promoted for weight loss is dangerous for diabetics, because eating too many protein foods (such as meat and eggs) can compromise kidney function. High carbohydrate diets (e.g., eating only fruits) may raise the blood sugar levels too much. Instead of fad diets, eating the right balance of protein, fats, and carbohydrates helps to maintain near-normal levels of sugar in the blood.

A current dietary debate is whether some kinds of carbohydrates are better than other types. Researchers are studying a factor called glycemic index, defined as the speed at which blood glucose levels rise after eating specific foods. Some carbohydrates (e.g., refined starches, flours, and sugars) seem to cause a more rapid increase in blood sugar than other carbohydrates



(whole grains and vegetables). Further research is needed to determine if this occurs in typical meals, and how blood sugar management is affected over the long run. Meanwhile, one may choose to eat more whole grains and vegetables and limit refined starches such as white rice, potatoes, and pasta while periodically testing one's blood sugar to observe the effects of various foods on the individual.

#### *Activity/Exercise*

As noted above, adequate exercise is one of the cornerstones for managing diabetes. Proper exercise benefits people with diabetes by enhancing the body's ability to use food and insulin, helping manage body weight, enhancing heart and blood vessel function, and promoting energy and positive mood. People with diabetes should remain active and have a prescribed exercise plan that fits their individual treatment program. The ADA guidelines are (a) exercise four to five times per week for 20 to 30 minutes, (b) monitor blood glucose levels to determine response to exercise, (c) eat a carbohydrate snack before exercising if blood glucose is less than 100 mg/dL, (d) carry candy or fruit juice if low blood sugar is a problem during exercise, (e) be sure to remain well hydrated by drinking water, and (f) always wear a medical identity tag in case emergency care is needed. As with all aspects of daily life, individuals should use trial and error in their exercise plan to see what works to enhance managing diabetes with enjoying life.

#### MIND-BODY THERAPIES

Models for stress management, relaxation, hypnosis, and biofeedback in DM are predicated on the relationship between psychological stress, the stress hormones, and carbohydrate metabolism. The association may be direct (via neurochemical and neuroendocrine pathways) or indirect, that is, mediated by behavior. The effects of the mind-body therapies depend on mental training (relaxation, adaptive coping, positive attitude) to decrease the mobilization of glucose from storage sites. The relationship between stress and blood glucose is variable among individuals, although most people react to acute or chronic stress with hyperglycemia rather than hypoglycemia. Evidence also exists that the mind-body therapies can facilitate lowering of blood pressure and blood glucose.

#### Support From Family and Friends

Behavior therapy is useful for family members of persons with DM, particularly adolescents with Type 1 DM. Less conflict within the family is associated with less reported personal stress for the diabetic person and lower blood glucose. Education of the best friends of adolescents increases support of the teen with DM and facilitates better self-care. When family members and the all-important peer group have a higher level of knowledge about diabetes, the teen copes more positively with the demands of the illness and is not embarrassed to take insulin or to make sensible food choices. The person with diabetes should also be viewed in the context of culture and ethnicity. People of different cultures react with considerable variability to the diagnosis of diabetes and management. Some believe that it is God's will or occurred simply by chance. The person's health beliefs and view of the care provider are relevant to adherence, particularly in intensive monitoring and medication regimens.

#### Cognitive-Behavioral Therapy

Both anxiety and mood disorders are treatable with cognitive-behavioral therapy (CBT). Countering negative cognitions and working through problems using a structured approach has been successful in decreasing psychological symptoms, decreasing the frequency of the stress response, and secondarily improving glycemic control. Often medical management is coupled with CBT for a more rapid response in individuals with more severe symptoms. Coping skills training assists persons with DM to overcome barriers to control and facilitates a sense of personal empowerment in self-care. Adaptive coping is associated with an improved sense of control further exemplified in decreases in glycohemoglobin. The positive effects achieved by learning are maintained over the long term.

#### Biofeedback-Assisted Relaxation

Biofeedback is a form of psychophysiological therapy in which an instrument monitors activity or physiological function, integrates the information, and displays it in an audio or visual format. Electromyograph and thermal biofeedback are used to provide

information about skeletal muscle tension and temperature of the hands and feet. Biofeedback is commonly combined with relaxation therapy in DM. Relaxation may include deep breathing, passive concentration, progressive relaxation, and imagery. About 8 to 12 sessions are necessary to learn the techniques. Home practice of relaxation is critical to skill building and generalization of the relaxation response.

Biofeedback has been studied in Type 1 and Type 2 DM with inconsistent results, despite improvements in anxiety in the participants. Positive effects on average blood glucose and percentage of fasting blood glucose values at target were observed in several studies of Type 1 DM. However, subclinical and clinical depressive symptoms appeared to impede the acquisition of the relaxation response or perhaps interfered with adherence to relaxation practice requirements or other self-care behaviors. Significant negative correlations were found between the magnitude of decrease in blood glucose and anxiety, negative mood, and number of daily hassles. A recent large study of stress management comprising progressive muscle relaxation and cognitive and behavioral skill training was carried out in Type 2 DM. At 1 year, significant decreases in glycosylated hemoglobin were observed. The group format used makes the use of relaxation-based therapy more practical and cost efficient. In addition to specific effects on blood glucose, thermal biofeedback has other applications relevant to DM. Acquisition of the foot-warming response with feedback is associated with improvements in peripheral circulation, faster healing of foot ulcers, and reduction in neuropathy pain in the feet.

### Complementary/Integrated Medicine Therapies

People with diabetes seek complementary therapies to decrease blood glucose, manage complications, gain a greater sense of control in their own disease management, or obtain a general improvement in quality of life. Types of therapies frequently sought by persons with DM include yoga, hypnosis, herbal products, massage, and meditation. For example, the regular practice of yoga exercises decreased the fasting and postprandial blood glucose values in Type 2 DM. As glycemic control improved, participants required fewer oral medications. However, controlled studies of these therapies in diabetes are sketchy, so blood glucose should be monitored closely by the management team. It should also be recalled that

interventions such as yoga are actually meant to be part of complete lifestyle programs, whose goals are broader than just decreasing blood glucose. Healthy nutrition, fitness, spiritual exercises, and better management of stress are incorporated in a total package that is meant to continue throughout the life span.

### SUMMARY

Long-term success in regulating blood glucose is a continuing challenge for people with diabetes. Empowerment is the term used to indicate high patient sense of self-efficacy in making good decisions in meal planning and activity. In that context, relapse into inactivity and overeating should be considered as a temporary relapse. The high blood glucose values may be due to psychological state, recent stress, or incipient clinical symptoms. In all cases, the patient's determination to get back on track should be affirmed. For the person with diabetes, the results of choosing well are both immediate and long term. In the short term, one has more energy and better mental function, feels less depressed, and has better vision when blood sugar levels are normal. In the long term, people with diabetes who eat well, stay active, and have learned to control the impact of psychological stress have fewer complications of diabetes. The treatment plan should not only consider blood glucose values and glycohemoglobin data but also cultural and personal health beliefs, mood, anxiety, coping, and social support.

—Angele McGrady and Sharon Williams Utz

See also CHRONIC DISEASE MANAGEMENT; DIABETES; PSYCHOSOCIAL ASPECTS; HEALTH BELIEF MODEL; METABOLIC SYNDROME AND STRESS

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## DIABETES: PSYCHOSOCIAL ASPECTS

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This entry provides a summary of key findings from the behavioral science literature focusing on psychosocial aspects of diabetes mellitus (DM). The review considers specific issues such as psychosocial adjustment and psychiatric disorders, neurocognitive functioning, quality of life, stress and coping, family functioning, and psychosocial therapies. Children and adolescents are considered first, followed by a discussion of psychosocial issues in adults with diabetes.

### CHILDREN AND ADOLESCENTS

The incidence of Type 1 DM in young children has increased in recent years. In addition, the incidence of Type 2 DM has been increasingly recognized in older children and adolescents, often in association with obesity. Large numbers of children are currently affected by diabetes, and many more will be affected by diabetes in the future.

Diabetes imposes substantial demands on children and their families. As they are coping with normal developmental challenges, the additional burden of diabetes may be difficult for many children and families to deal with effectively. Especially challenging may be the demands of intensive management. Families play a significant role in the management of diabetes in children and are instrumental in the implementation of interventions. The quality of life of all family members may be affected by diabetes.

### Psychological Adjustment

Studies have shown that Type 1 DM is a risk factor for the development of psychiatric disorders in children and adolescents. For example, many children have adjustment problems soon after the diagnosis of diabetes. While the majority of these problems resolve within the first year, continued problems increase risk for poor adaptation to diabetes, including regimen adherence problems, poor metabolic control, and persistent psychosocial difficulties. Many mothers of newly diagnosed children are also at risk for adjustment problems of their own, with significant depressive symptoms observed in approximately one third of mothers; however, the majority of these subside within the first year after their child's diagnosis risk.

Research has also shown that risks for depression and eating disorders are higher in youths with diabetes and likely to be associated with poor metabolic control. A 10-year longitudinal study found nearly half of the study sample had a psychiatric diagnosis, the most frequent being depression. Another 10-year longitudinal study found lower self-esteem among young adults with diabetes. Poorer psychological adjustment during adolescence may persist into adulthood.

Studies also indicate that diabetic youth, particularly adolescent girls, are at increased risk for eating disorders. Both eating disorders and subclinically disordered eating attitudes and behaviors (e.g., repeated insulin omissions and severe dietary indiscretions) have been observed in adolescent girls with diabetes and are associated with worse metabolic control diabetes. Without intervention, disordered eating and insulin manipulation may worsen over time and increase the risk of health complications. At least 10% of adolescent girls with Type 1 DM meet diagnostic criteria for an eating disorder, a rate twice as common as in girls without diabetes. Without intervention, disordered eating and insulin manipulation may worsen over time and increase the risk of health complications.

### Neurocognitive Functioning

Studies indicate that children who develop diabetes prior to age 5 and/or who have frequent episodes of hypoglycemia are at risk for neurocognitive deficits, particularly in visual-spatial functioning. In addition, research has shown that children with diabetes miss more school than peers without diabetes, and that lower reading achievement was related to more school

absences. Learning problems are more likely in diabetic children, especially among boys.

Other research has found that children with a history of significant hypoglycemia have poorer attentional functioning and lower verbal intelligence. A longitudinal study with newly diagnosed children revealed declines in verbal intelligence and school grades, predicted in part by memory dysfunction. Another study showed that several years after diagnosis, children exhibited mild neuropsychological deficits, including reduced speed of information processing and decrements in conceptual reasoning and acquisition of new knowledge, which were predicted by both recurrent hypoglycemia and hyperglycemia, as well as early onset (prior to 5 years of age) of diabetes.

### Quality of Life

Relatively few studies have specifically examined quality of life in children and adolescents with diabetes, and those that are available have used a disease-specific measure. Research findings indicate that better diabetes quality of life in youths is associated with increased self-efficacy and less depression. Findings relating quality of life to glycemic control have been inconsistent. However, a recent study of over 2,000 adolescents found that better glycemic control was associated with lower impact, fewer worries, and greater satisfaction. In addition, girls reported more worries and less satisfaction than boys, and patients from ethnic minority groups had more impact and worries. More studies using generic measures of quality of life are needed.

### Stress and Coping

Researchers have also studied the role of stress and coping in relation to diabetes management. Findings indicate that children who have less life stress and who cope well with diabetes management are more likely to have fewer problems with regimen adherence and glycemic control. High levels of self-efficacy and low levels of learned helplessness have been associated with good glycemic control. Specific health beliefs related to the seriousness of diabetes, personal vulnerability to complications, costs of regimen adherence, and beliefs in the efficacy of treatment have also been associated with both regimen adherence and glycemic control.

### Demographic and Family Factors

Research has demonstrated that regimen adherence and metabolic control typically decline over time, and that the risk of metabolic control problems is higher among single-parent, lower-income, and African American youths. Family factors are reliably associated with regimen adherence and metabolic control: low levels of family conflict and stress, high levels of cohesion and organization, good communication skills, and appropriate involvement of both parents and children in diabetes management have been associated with higher levels of regimen adherence and better metabolic control. When parents allow adolescents to have self-care autonomy without sufficient cognitive and social maturity, they are likely to have more problems with diabetes management.

### Psychosocial Interventions

A number of controlled studies have examined the efficacy of psychosocial interventions for diabetic children and adolescents. Most of these have included the family as an integral part of treatment. Research findings indicate that family-based behavioral procedures such as goal setting, self-monitoring, positive reinforcement, behavioral contracts, supportive parental communications, and appropriately shared responsibility for diabetes management have improved regimen adherence and glycemic control. In addition, such interventions can improve the parent-adolescent relationship. Interventions with children and their families that promote problem-solving skills and increase parental support early in the disease course have improved long-term glycemic control of children. The efficacy of group interventions for diabetic youth has also been systematically evaluated. For example, research findings have shown that peer group support and problem solving have improved short-term glycemic control. In addition, stress management and coping skills training have reduced diabetes-related stress and improved social interaction and quality of life in adolescents.

### ADULTS

Because diabetes is such a psychologically and behaviorally demanding disease, psychosocial factors are relevant to nearly all aspects of its management. In studies with adults with diabetes, the psychosocial

impact of diabetes has been recognized as a stronger predictor of mortality than many clinical and physiological variables. Given the importance of psychosocial factors in diabetes management, the rapidly increasing number of adult patients with diabetes (mostly Type 2), and the growing and substantial public health burden of diabetes, the development and clinical implementation of effective psychosocial interventions are essential. Such interventions could help patients improve self-care behaviors and glycemic control, thus improving their quality of life and reducing their risk of health complications.

### Psychological Functioning

A substantial research literature has documented the prevalence and course of psychiatric disorders in adults with diabetes, particularly affective and anxiety disorders. Research findings indicate that depression is more common in patients with diabetes than in the general population, with at least 15% of patients having clinical depression. Depressed patients are likely to have worse glycemic control and more health complications, as well as decreased quality of life, and depression is likely to be persistent. A recent meta-analytic study demonstrated the association of depression with hyperglycemia and complications in both adult Type 1 and Type 2 DM. Furthermore, results from prospective studies indicate that depression doubles the risk of the incidence of Type 2 DM independent of its association with other risk factors. In patients with preexisting diabetes, depression is an independent risk factor for coronary heart disease and appears to accelerate its presentation. Research has also shown that anxiety disorders are also common in adults with diabetes and associated with poor glycemic control.

There is evidence that the adverse effects of depression and anxiety on diabetes can be lessened by psychiatric treatment. Randomized controlled intervention trials have shown that treatment with either cognitive-behavioral therapy or antidepressant medication can improve both mood and glycemic control. Psychopharmacologic interventions have also been shown to reduce anxiety and improve glycemic control.

Studies indicate that eating disorders such as bulimia are common in adults with diabetes, especially among young women with Type 1 DM. Research has also demonstrated that eating disorders are associated with poor glycemic control and increased risk for retinopathy.

### Psychosocial Factors and Stress

Research has also examined the effects of the social environment on diabetes management. For example, greater levels of social support, especially diabetes-related support from spouses and other family members, have been associated with better regimen adherence. Increased levels of environmental stress have been associated with lower regimen adherence and poor glycemic control; however, the effects of stress appear idiosyncratic and depend upon a number of factors, including the type of stressor and coping response and prestress metabolic factors. There is also evidence indicating that social support may buffer the negative effect of environmental stress on blood glucose.

Research findings suggest stress may be involved in the etiology of Type 2 DM. For example, studies with the ob/ob mouse (genetically obese mouse) have shown that environmental stress interacts with obesity to increase glucose intolerance. This hyperglycemic stress response can be lessened by antianxiety drugs and can be classically conditioned. Recent studies with humans provide support for the idea that stress may increase the risk for Type 2 DM.

### Neurocognitive Functioning

Neurocognitive deficits have been observed in adults with Type 1 DM. Patients with at least five episodes of severe hypoglycemia and those with peripheral neuropathy appear at greater risk. Poor glycemic control has been related to cognitive deficits in studies with older adults with Type 2 DM.

### Quality of Life

Studies have shown that diabetes-specific quality of life of adults is improved by increased physical activity and adequate social support. Improved quality of life has also been demonstrated after intensification of insulin regimens, an effect related to patients' greater perceived flexibility in physical activities and diet. Quality of life is adversely affected by the presence of health complications and comorbid psychiatric disorders, as well as physical complaints and worries about the future. In addition, research has shown that quality of life is lower when diabetes-specific health behaviors are perceived by patients as burdensome.

## Psychosocial Therapies

A number of controlled studies have evaluated the effects of psychosocial interventions for adults with diabetes. A recent meta-analytic review of diabetes self-management interventions showed significant improvements in glycemic control, as well as reductions in diabetes-related hospitalizations and health care costs, particularly when interventions incorporated individually tailored behavior change strategies. For example, interventions that increase patients' self-management skills and sense of empowerment have resulted in improvements in self-efficacy, self-care behaviors, glycemic control, patient satisfaction, and quality of life. These benefits have also been found in studies with older minority patients with Type 2 DM. Blood glucose awareness training with patients who have Type 1 DM has been shown to reduce the frequency of severe hypoglycemia episodes, diabetic ketoacidosis, and automobile accidents, as well as reduce the fear of hypoglycemia.

## SUMMARY

A significant amount of behavioral science research has demonstrated that psychosocial factors play an integral role in the management of diabetes in children, adolescents, and adults. In particular, patients with diabetes are at increased risk for psychiatric disorders, including depression and eating disorders, and these disorders are associated with glycemic control problems and health complications. Environmental stress and maladaptive coping and health beliefs are associated with problems with regimen adherence and glycemic control, while effective social support and adaptive coping are related to improved diabetes management behaviors and glycemic control. Research has shown the efficacy of a number of psychosocial therapies that can improve self-care behaviors, glycemic control, and psychosocial functioning and quality of life. More research is needed to develop psychosocial intervention programs for specific patient populations and to demonstrate the cost-effectiveness of these approaches.

—Alan M. Delamater

See also CHRONIC DISEASE MANAGEMENT; DIABETES; BEHAVIORAL TREATMENT; HEALTH BELIEF MODEL; METABOLIC SYNDROME AND STRESS

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## DIFFUSION OF INNOVATION

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The diffusion of innovation model offers a schema for understanding how change takes place within a social system. The model is based on two underlying premises: (1) new ideas, products, and practices can alter the structure and function of a social system, and (2) communication is essential for the diffusion and subsequent acceptance or rejection of new ideas. The diffusion of innovation model describes how an idea, a product, or a process—labeled an innovation—spreads or diffuses through a defined social structure. One measures change by calculating how many people or groups of people adopt the innovation over time.

The diffusion of innovation model grew out of an interest in social transformation. Anthropologists and sociologists explored the consequences of the development, the spread, and the adoption or rejection of innovations that changed a social system. For example, anthropologists such as Robert H. Lowie

and Clark Wissler retrospectively studied the spread and modification of dance ceremonies among Native American groups, the introduction of the horse within and among indigenous population groups of North America, and the spread of corn cultivation from America to Europe. Early sociological studies in Europe and in the United States explored social and legal trends, the influence of a city on surrounding areas, the diffusion of governing practices, and the use and consequences of technology such as radio. Rural sociologists such as Herbert F. Lionberger and anthropologists such as Ward H. Goodenough focused on the spread of new ideas among farmers and the subsequent change in agricultural practices. Thousands of studies in myriad fields have added to diffusion literature. Everett M. Rogers charts this literature in a 1995 text, and earlier, Rogers and F. Floyd Shoemaker offered findings, primarily from agriculture and development studies, in the appendix of their 1971 text.

The diffusion of innovation model influenced the development of communication theories and social marketing models and continues to be widely applied in marketing, education, policy, health communication, and public health. Lessons learned from diffusion studies in rural sociology, education, folklore, communication, marketing, economics, and public health have helped contemporary scholars and practitioners transform the diffusion of innovation model from a descriptive model into a proscriptive one. Marketing experts and public health practitioners, for example, apply lessons from observational studies to purposively shape innovations and to plan programs of change. As a result, what had been a descriptive model is used as a theory to guide the design of products, programs, and communication strategies.

## KEY FACTORS IN THE DIFFUSION MODEL

The diffusion of innovation model focuses on change, offers a schema for understanding how it takes place, and measures it by calculating how many people adopt the new idea or practice. Scholars contributing to the descriptive diffusion model analyzed many features of the process and highlighted specific elements that impeded or facilitated the communication and adoption of new ideas. Research findings across many fields of study indicate that the diffusion of ideas among individuals within social groups depends on the features of the innovation, the channels

of communication, time factors, and the characteristics of the social system. Program planners and communication specialists, using the model to shape their work, may modify one or more of these elements to speed up the diffusion process and to engage groups that might ordinarily learn about the innovation much later in the process or not at all.

## The Innovation

An innovation may be a product, a practice, or an idea. It may be a recent invention or simply something new to members of a particular social group, as was the horse to the indigenous population of North America when the Spaniards first arrived. An innovation perceived as useful by members of a population may more easily spread than would an innovation seen as odd and of little relevance.

Descriptive studies indicate that the characteristics of an innovation clearly influence diffusion, adoption, and rejection. These characteristics include the dimensions of an item, the meaning it has for people, and whether or not people can easily talk about it, see it, and try it. Potential adopters consider the social and financial costs of trying out and/or adopting the idea or item and often weigh these costs against anticipated benefits. The ramifications of acceptance, including value as well as possible loss or danger, are important concerns.

Thus, the features of the innovation are critical considerations and will influence the diffusion process. For example, an innovation that fits with existing practices or beliefs, that is relatively simple, that has low investment costs, and with yields and benefits that can be easily observed by others will have advantage over one that clashes with predominate beliefs, is complex, costly, and subtle.

Many innovations, however, are adopted in part, put to new uses, or are modified by social groups or institutions. Such reinvention is part of the diffusion process. Consequently, innovations must be considered malleable. Those seeking to trace the diffusion process for a particular item may well need to differentiate between those item characteristics that are key and those that can be easily discarded without compromise. Public health nutrition program designers, for example, often seek to package or modify messages to achieve a better fit with a particular population's food preferences and needs but keep, as core, the central defining nutritional components.

## Communication Processes and Channels

Geography, social norms, and social structure shape communication, the key element in diffusion. These, in turn, determine differential access. Therefore, diffusion depends upon information exchange processes and on considerations such as who talks to whom, who is considered influential and trustworthy, and who has easy access to or is barred from various communication channels.

Communication channels include interpersonal as well as local and mass media. Interpersonal considerations often examined in diffusion studies include the characteristics of those people who introduce the innovation, of those who provide information or advice, and of those who influence the decision to try, adopt, or reject the new idea. Early diffusion studies indicate that initial innovators are often viewed as deviants by members of social and institutional groups and are accorded dubious status. Others, called opinion leaders, have access to outside channels of communication and are often in a position to learn about these innovations and observe the use put to them by those on the edge of their community. Opinion leaders, however, have high social status, and their adoption of an innovation is consequently viewed more seriously. Thus, opinion leaders tend to officially introduce the innovation to a large social group. Others, often professionals, show or bring the innovation to others as part of their role. They may more directly influence decisions of members of multiple social groups and are called change agents. They tend to be most powerful in this role when they are very like or are actual members of the groups faced with adoption decisions. Overall, the social and geographic proximity of various members of the population to opinion leaders and to agents of change will influence the flow of ideas and the adoption processes.

In a similar manner, researchers analyze the more distant and less personal media in terms of scope and reach and examine differential access to the local and mass media among various population groups. The mass media channels of national radio, newspapers, television, and the Internet may reach a select group in a population; however, the more local media such as postings, newsletters, and community radio may reach others who do not have easy access to the more costly or distant channels.

Modification in the various channels of communication can serve to facilitate the diffusion process. For example, Internet use spread more widely among less

affluent population groups once public access to computers and to the Internet were possible through cafes, libraries, and schools. In addition, findings from adult literacy surveys conducted in the early and mid-1990s within 22 industrialized nations brought attention to issues of literacy. These included the reading level of written materials, the vocabulary and format of spoken messages, and the functional literacy skills of members of the population. This work enabled program and communication designers to identify barriers that had not been attended to earlier and make modifications in written and oral messages designed for the public.

## Time

Analysts chart the diffusion process over time and consider the number of individuals, groups, or collectivities who adopt an innovation as the unit of analysis. Some innovations diffuse quickly through a population; others move slowly. Characteristics of the innovation, of the communication channels, and of the social system will influence the time it takes for an idea or process to take hold.

Analysts and program evaluators can track the diffusion process, over time, from the introduction of the innovation to adoption or rejection. Consequently, they can determine the direction of the flow of information, develop mathematical descriptions of variations in the process, and construct models.

The time element was also used by early contributors to the diffusion literature as a mechanism for dividing adopter groups into categories such as innovators, early adopters, early majority, late majority, and laggards. A deeper understanding of the social structure, however, helped many researchers and program designers recognize that “laggards” were often those who were distant, disadvantaged, or marginalized. Program and communication planners need to identify the characteristics of those who adopt an innovation early and those who come late to the process. Such information yields insight into needed modifications in the product, message, or communication processes. Thus, while time can be used to delineate groups, the social system factors must be used to understand them.

## SOCIAL SYSTEMS

Diffusion of innovation is always studied within a social system that is defined by geography, culture,



politics, affiliations, and/or institutions. The social and geographic boundaries of the structure within which an innovation is introduced will influence the flow of the diffusion process. Laws, rules, and norms influence patterns of interaction and govern communication. Structural arrangements within and between groups may limit or facilitate such patterns. Thus, systems influence both the flow of ideas and the behavior of members.

Characteristics of the social system also shape the types of decisions that can be made. Certain structures allow for optional individual decisions; others foster normative collective change; some impose change based on authority and power. Therefore, researchers and practitioners consider power and hierarchy, map differentiation and distribution of roles and status, examine networks of social relations, and seek to understand the values of the dominant as well as of the less powerful groups in a social system. For example, some groups in a society may hoard information about innovations for their own profit because they miscalculate others' interests or capabilities, or because they are unable to communicate across social divides. In addition, access to resources, including information, may differ between and among groups. These analyses enable program planners in public health, for example, to consider social determinants of health in the design of programs for healthful change. Consequently, innovations are often introduced to legislative bodies and institutions because changes in laws, in institutional patterns, and in physical as well as political and economic environments are often considered precursors to individual or community change.

—Rima E. Rudd

See also HEALTH COMMUNICATION; HEALTH LITERACY; SOCIAL MARKETING

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## DISASTERS AND HEALTH

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Research on cataclysmic events such as war, disasters, abuse, assault, and other traumatic or highly threatening events has increased over the past 50 years, as interest in extreme stress has increased as well. This work has overcome a number of methodological obstacles in studying these events and has applied eclectic theory and clever logistical solutions to what are often massive disruptions in people's daily lives. The study of disasters has developed very rapidly, and we have a much better understanding of how people react to them than we did even 20 years ago. This research highlights the extremely stressful nature of disasters and the conditions that convey most threat as well as the remarkable resiliency of humans and their ability to cope effectively with often overwhelming demands. We have also learned about some of the major effects of disasters on victims' mental and physical health.

### DISASTERS

Disasters generally refer to extremely disruptive, threatening, and potentially destructive events and their impact, as when a tornado outbreak strikes a community or an earthquake wrecks a part of a major city. In fact, disasters are best viewed as *disaster events*, powerful events that can cause substantial disorganization, death, disruption, and destruction to an area and the disaster itself, which reflects the degree to which disorganization and disruption materialized and destruction and bodily harm actually occurred. All hurricanes, for example, carry the potential to cause a disaster. The extent to which they cause such outcomes depends on their strength, speed, predictability, and where and when they strike. Striking at low tide or where few people live will minimize disaster impact, as will preparedness. *Disasters*, then, refer to situations surrounding disaster events characterized by considerable disruption of social and personal activities or networks, disorganization, and/or substantial injury, damage, and loss of life.

## Natural Disasters

Natural disasters are the most familiar of disasters, distinguished by their cause by natural events. Flooding, storms, earthquakes, volcanic eruptions, tornadoes, and avalanches are examples of natural disaster events, and as described above, these events may or may not cause disruption, disorganization, and death. Natural disasters are caused by natural forces and are not under human control. They are uncontrollable because they are a product of natural forces that we cannot stop. We can predict where and when they occur (in some cases), and this can help minimize disaster impact by allowing preparation or evacuation. However, natural disasters occur as a result of powerful, uncontrollable natural forces, and the extent to which the impact of these forces creates disasters depends on whether they cause significant distress, disorganization, and/or death or injury.

## Technological Disasters

Technological disasters are similar in many ways but are caused by events of human origin. This means that the disaster event is something that humans built, as in the case of building collapses, airplane crashes, nuclear power station accidents, or release of toxic agents, as in the cyanide disaster at Bhopal or the more gradually developing toxic hazards at Love Canal. These events are generally powerful and uncontrollable, like natural events, but represent a breakdown or loss of control over technology that normally is under human control. This *loss of control* over events assumed to be under our control may increase the duration of disorganization, disruption, or distress associated with technological disasters.

## MENTAL AND PHYSICAL HEALTH OUTCOMES

Disasters have a wide range of effects, including stress, stress-related mental health problems such as posttraumatic stress disorder (PTSD), and some profound psychopathology. Disaster-related stress can be associated with decrements in physical health such as increases in illness symptoms and progression of disease processes, not only during the initial aftermath of the disaster event but in the years following recovery. This relationship may be due, in part, to the effects of stress on important regulatory systems in the body, immune activity, cardiovascular reactivity, and other

systems that may affect health or contribute to disease. Poorer immune function could affect progression of already established diseases such as cancer or HIV disease, could affect inflammatory processes or immunization, and/or could affect vulnerability to viral infection. Stress-related cardiovascular changes include narrowing of arteries, increased adhesiveness of platelets, and increased demand on coronary arteries, and could contribute to this disease profile and/or precipitate cardiovascular events. For example, a middle-aged woman who has lost her home due to a tornado may experience more respiratory infections with more severe or more prolonged symptoms in the year following the tornado. At the same time, she may be exhibiting increases in cardiovascular reactivity. Continuation of distress and increases in physiological arousal may contribute to the development of hypertension 5 years after the tornado. Alternatively, in the case of disasters involving toxic hazards, stress may affect detoxification processes or other protective activity and ultimately influence the impact of toxic exposures.

Research has shown that disasters can have effects on physiological responses and bodily symptoms that can contribute to the etiology of disease or its progression. Heart rate, blood pressure, and stress hormones have been increased by disasters. And these changes may precipitate illnesses, particularly in cases where social support is atomized by the disaster, either due to death or dispersal of friends and family. Coping reserves may also be depleted by the massive coping required during the disaster event, intensifying these and other bodily responses. Health effects of disasters may increase when the period of intense stress is prolonged or when effects of the disasters last a long time.

Disaster victims may also worry about the possibility of negative health effects. They may believe that disaster event exposure will increase their risk not only for acute illnesses such as viral infections but also more chronic diseases such as cancer. These health concerns may be particularly prevalent after exposure to disasters involving the release of toxins such as chemicals or radiation fallout, but have also been documented in samples of victims exposed to natural disasters such as volcanic eruptions and floods. This worry and uncertainty over physical health outcomes may serve as an additional stressor and may potentiate disaster-related stress responding and could indirectly contribute to the manifestation of illness.

Stress due to disaster may also affect key health-related behaviors, like medication adherence, diet, and tobacco, alcohol, or illicit drug use that may have further effects on physical health. One can imagine scenarios such as one that would feature a young man experiencing stress due to a disaster event who copes by overconsumption of alcohol, which could lead him into high-risk sexual encounters, which could expose him to an infectious agent that would be only minimally defended by an immune response restrained by stress.

Most people affected by disasters recover fairly quickly, and within 1 year following disasters, the vast majority of people involved will have met the demands posed by the disaster and moved on with their lives. This does not appear to be the case with technological disasters, after which stress is less intense than during or right after natural disasters. However, stress following technological disasters appears to be more persistent and difficult to overcome. This could mean that technological disasters are more likely to have effects on physical health.

Some examples are illustrative. The nuclear accident at the Three Mile Island Nuclear Power Station (TMI) in 1979 was a watershed event for the nuclear power industry and spawned a good deal of research on the short- and long-term effects of nuclear accidents. The accident occurred when mechanical failure in the system that cooled the radioactive core and human error combined to expose the core and permit radioactivity to be released. Most of this radioactivity was captured within the reactor building, in water that spilled onto the building floor or as radioactive gas trapped in the reactor containment building. Once the immediate threat of meltdown or other serious mishap was controlled, the danger posed was reduced and area residents should have breathed easy. However, many did not, and a substantial minority of people living near the plant continued to experience stress for several years. Sympathetic hormones (epinephrine and norepinephrine) were elevated for at least 7 years, as was blood pressure and cortisol levels. Immune system activity was altered as well, and 5 years or more after the accident, some area residents showed smaller numbers of some immune cells and poorer control of latent viruses. Although none of these data provide a direct link to disease, chronic elevation of stress hormones and of blood pressure could contribute to hypertension or cardiovascular disease and possibly cause some of the observed immune

changes. The human cause of the TMI accident was coupled with the fact that the chief source of threat was radiation, which has effects that may take years to become evident. This meant that many area residents who feared that they had been exposed to radiation because of the TMI accident were worried about future harm yet to be realized. This kind of uncertainty is a prime contributor to chronic stress and to the kinds of effects observed.

Stress following the TMI accident also interfered with sleep, a key restorative process involved in maintenance of good health. Three years after the accident, TMI area residents reported more symptoms of physical discomfort, more awakenings during the night, and more time needed to fall back to sleep than did control participants living more than 75 miles from TMI. They also showed an unusual increase in stress hormones from when they were awake to when they were asleep. Control participants exhibited lower levels of stress hormones while asleep.

Other disasters have produced evidence of long-term effects that could contribute to ill health. Some involve sufficient exposures to cause death and disability directly. Following the nuclear accident at Chernobyl, in the Ukraine, some deaths occurred that were directly attributable to the accident. Similarly, during the cyanide release by the industrial plant in Bhopal, India, many victims died directly due to the release of the lethal gas. In addition to this, victims appear to have experienced significant distress and exhibited symptoms of stress similar to TMI-area residents.

The negative mental and physical health effects of disasters that are described above have been well documented in the literature. Fortunately, in most cases, these effects diminish rapidly over time as the victim deals effectively with the demands imposed by the disaster. However, for some victims, whose disaster event exposure was more intense or for whom their coping skills are not effective, stress symptoms can last for years to decades, and it is this group of victims who are especially at risk for long-term mental and physical health problems. In addition to these negative outcomes of disasters, a small literature is growing that documents positive mental health effects of disasters. Disaster victims report growing from their experiences in ways such as appreciating life and one's own vulnerabilities, putting more effort into relationships and becoming closer to support persons, and making changes in priorities. Perceiving a benefit

from exposure to a disaster may help to attenuate disaster stress and reduce concomitant physical health effects.

—Andrew Baum and Angela Liegey Dougall

See also STRESS, APPRAISAL, AND COPING

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## DISCRIMINATION AND HEALTH

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In race-conscious societies, race is a powerful predictor of access to societal rewards and a determinant of variations in health. Where social inequalities exist, discrimination is a key feature of intergroup relationships. Discrimination is important in serving to reinforce the symbolic boundaries that separate social groups from each other. Thus, racial categories capture an important part of the inequality and injustice that has historically and currently characterized racialized societies. There are multiple ways in which

discrimination maintains these social inequalities. Arguably, the most important mechanism in the United States context is an institutional one. Residential segregation is a primary cause of racial differences in socioeconomic status because it determines access to education and employment opportunities. In addition, segregation can have deleterious effects on health through the negative conditions it creates in residential environments. In addition, there is growing research interest in the ways in which the subjective experiences of discrimination may be an additional mechanism by which discrimination may affect health. This latter mechanism is the focus of this entry.

## THE PERSISTENCE OF DISCRIMINATION

There have been dramatic improvements in the racial climate in the United States in the last 50 years. On virtually every indicator of the endorsement of the principle of equality, there has been a large positive shift on the part of the White population, with the overwhelming majority of White Americans endorsing equality of opportunity for Blacks and other minorities in virtually every area of evaluation (Schuman, Steeh, Bobo, & Krysan, 1997). At the same time, other data suggest that racial attitudes are complex. The overwhelming support for the principles of equality coexist with substantial reluctance to support policies that would reduce racial inequalities (Schuman et al., 1997). In addition, data on stereotypes reveal the persistence of negative images of African Americans and other minorities. National data indicate that 56% of White persons believe that Blacks prefer to live off welfare, 51% believe that Blacks are prone to violence, 29% view Blacks as unintelligent, and 44% view them as lazy (Williams & Williams-Morris, 2000). Similarly, one in five or fewer Whites believe that Blacks are hardworking, not prone to violence, are intelligent, and prefer to be self-supporting. Moreover, Whites view all of the major ethnic minority populations more negatively than they view themselves, with African Americans viewed more negatively than all other groups and Hispanics viewed twice as negatively as Asians. Social psychological research indicates that when individuals hold a negative stereotype about a group, they will discriminate against an individual member of that group if they encounter one. Most important, this research shows that this process is both automatic and

unconscious (Hilton & Von Hippel, 1996). Thus, the persistence of negative racial stereotypes suggests that there will be widespread racial discrimination in the United States, with many perpetrators of racial bias being unaware of their discriminatory behavior.

Carefully executed scientific studies document the persistence of racial discrimination in multiple areas of society. Audit studies in employment and housing where Black and White applicants with identical qualifications apply for jobs or housing document continuing discrimination (Fix & Struyk, 1993). For example, audit studies in employment find discrimination that favors the White over the Black applicant 20% of the time. Similarly, a recent report from the Institute of Medicine documents widespread discrimination in the quality and intensity of medical treatment for a broad range of procedures in the United States (Smedley, Stith, & Nelson, 2003). Victims of discrimination are aware of at least some of these experiences and are able to describe them in both qualitative and quantitative research studies.

### **Discrimination: A Pathogenic Stressor?**

It has been argued that subjective experiences of discrimination are an important domain of stressful life experiences that traditional batteries used to assess stress have not included (Clark, Anderson, Clark, & Williams, 1999; Williams, Neighbors, & Jackson, 2003). Consistent with this view, equity theorists have also noted that perceptions of unfair treatment can lead to negative emotional reactions and psychosomatic symptoms. Several laboratory studies have assessed the physiological and affective reactions of African Americans to mental imagery and videotape vignettes of discriminatory behavior. These studies have found that exposure to such racist experiences leads to increased cardiovascular and psychological reactivity (Harrell, Hall, & Taliaferro, 2003). More generally, the experimental manipulation of unfair treatment in laboratory settings has a broad range of negative psychological consequences for individuals (Dion, 2001).

There are several reviews of the literature on the association between discrimination and health outcomes (Harrell et al., 2003; Krieger, 1999; Williams & Williams-Morris, 2000). This entry summarizes the findings of a recent review of population-based empirical studies that examined the association between perceptions of racial ethnic discrimination and health

and identified some 53 published studies (Williams et al., 2003). These studies have focused on both physical and mental health outcomes and we provide an overview of the research in each major area of investigation and some illustrative examples of the existing research.

### **DISCRIMINATION AND MENTAL HEALTH**

Mental health status is the most frequently assessed indicator of health in studies of discrimination. A broad range of mental health outcomes have been examined. These include measures of well-being, self-esteem, perceptions of control, psychological distress, anger, as well as specific psychiatric disorders such as major depression, generalized anxiety, and substance use. Moreover, some 80% of the 47 associations examined in the literature between measures of discrimination and an indicator of mental health found that higher levels of discrimination were associated with poorer mental health status. For example, a national study of over 3,000 American adults found that perceptions of acute and chronic discrimination were positively related to psychological distress, major depression, and generalized anxiety.

Most of the research studies in this area have been U.S.-based, and most studies have focused on the African American population. However, several studies have documented similar patterns of associations for other minority groups in the United States. For example, a study of over 3,000 Mexican Americans found that higher levels of perceived discrimination were positively associated with scores on the CESD depression scale. In a similar vein, a study of 1,747 Chinese American adults in Los Angeles who perceived discrimination based on race and language or accent was associated with psychological distress. A study of over 200 American Indian adolescents also found that perceived discrimination was associated with higher levels of substance use, psychological distress, and anger.

Equally impressive is the fact that studies in other countries are also finding inverse associations between discrimination and mental health. A study of 647 Southeast Asian refugees in Canada documented that perceptions of discrimination positively related to depressive symptoms. Studies in the Netherlands of both Iranian refugees, as well as Turks and Moroccans, find higher levels of discrimination associated with poorer mental health. Similar findings come from recent

studies in the United Kingdom. A national study in England and Wales found that perceptions of discrimination were positively associated with depressive symptoms and the annual prevalence of psychosis. A study in Ireland noted that experiences of discrimination were associated with higher levels of psychological symptoms among Black, Asian, and Arab adolescents and adults. A recent study of 1,146 immigrants in Finland also found an 18-item scale of discrimination to be positively related to levels of psychological distress.

## DISCRIMINATION AND PHYSICAL HEALTH

Multiple measures of physical health status have been examined (Williams et al., 2003). Six studies using a single-item global self-rated health measure have all found a positive association between discrimination and ill health. Nine of the 11 additional studies using other self-ratings of health or checklists of chronic illnesses documented that discrimination was related to poorer health status, at least under some conditions. For example, one recent study found perceived discrimination to be predictive of self-rated ill health and a composite measure of chronic health problems in a sample of 3,012 Mexicans in California. Similarly, in a probability sample of over 1,106 adults in Michigan, both chronic and acute discrimination were positively related to reports of ill health and chronic conditions for Blacks but not Whites.

There has been considerable interest in the association between discrimination and hypertension (Williams & Neighbors, 2001). Eleven studies have examined this association and the findings are mixed. Three studies have documented a clear positive association between discrimination and elevated blood pressure; in an additional five, this effect exists conditional on coping style, sex, socioeconomic status (SES), or race, and three studies find no association between discrimination and blood pressure. Illustrating the complexity of findings in this area, Krieger and Sidney (1996) found, in a sample of over 2,000 African Americans, that blood pressure levels were higher for women and working-class men who reported no discrimination *and* who reported discrimination in three or more social situations, compared to those with discrimination in one or two situations. Among professional men, discrimination was positively related to systolic and diastolic blood pressure.

Other health outcomes have also been examined. Perceptions of discrimination were unrelated to

self-reported heart disease in two studies, but a recent study found that perceptions of chronic discrimination were positively related to the onset of subclinical disease in the carotid artery for Black but not White women. Two studies have examined the association between perceived discrimination and low birth weight, and one has explored the association with adult mortality and the findings here have been mixed. Five studies have found a positive association between discrimination and cigarette use or alcohol consumption. Moreover, two studies have found that discrimination makes an incremental contribution above SES in explaining Black-White differences in self-reported health.

## RESEARCH ISSUES

In order to shed light on how perceptions of discrimination may be related to health, advances are needed in the conceptualization and measurement of discrimination and in the theoretical identification and the empirical verification of the plausible pathways by which this stressor can affect various health outcomes.

### Measuring Discrimination Comprehensively

Studies to date have not given sufficient attention to capturing exposure to discrimination comprehensively and to assessing the cumulative burden of such exposure over the life course (Krieger, 1999; Williams et al., 2003). Some studies have relied on single-item indicators of discrimination. Such approaches understate the actual level of discrimination. In most studies, participants' exposure to discrimination is measured at one point in time. In some studies, respondents were asked to provide a retrospective report about exposure to perceived discrimination over their life course, while other studies used a 30-day, 1-year, or 3-year time frame.

Research efforts are needed that would comprehensively characterize discrimination in multiple areas of social life. Like other stressful experiences, discrimination is multidimensional, and its assessment should provide coverage of all relevant domains. The most commonly assessed types of stressful experiences are life events, chronic stress, and daily hassles. Life events are discrete, observable stressors. Daily hassles refer to chronic irritations that are minor. Chronic stressors are ongoing problems that are often role related. They all have their analogues

among existing measures of discrimination. Major acute experiences of racial bias are the most commonly assessed type of discriminatory experience. The Everyday Discrimination Scale, developed by Williams and colleagues (1997), attempts to capture persistent and recurring, everyday, chronic minor experiences. However, that scale is generic, and it is important to capture measures of chronic discrimination in multiple domains, such as employment, educational, and public settings, as in the measure developed by McNeilly and colleagues (1996). In the general literature on stress, chronic stressors are stronger predictors of the onset and course of illness than are acute life events (Cohen, Kessler, & Underwood, 1995), but they are a challenge to measure. Measures of chronic exposure to discrimination are needed that directly assess the duration and frequency of exposure.

Traumas, nonevents, and macrostressors are other distinctive types of stress (Wheaton 1999) that point to promising areas of expansion for comprehensively assessing discrimination. Traumas are acute stressors, such as sexual assault that are severe, overwhelming in impact, and generally regarded as outside of the usual range of experience. Macrostressors are large-scale systems-related stressors such as economic recessions. Nonevents are desired and expected experiences that fail to occur. Most important, the various stressors have independent effects on health, such that an evaluation of the full impact of stress requires the inclusion of all relevant classes of stressors (Wheaton, 1999).

In addition to discrete acute and chronic experiences of discrimination, the structure and culture of racism can also create hostile environments in which the ever-present threat of discrimination can lead to heightened physiological arousal that can adversely affect health. Assessing the full impact of racism will require measures of vigilance that capture both the perceptions of danger in one's environment and the psychological and behavioral efforts to remain vigilant.

### Measuring Discrimination Accurately

There is concern in the literature that the salience of race can lead to some minority group members perceiving as race-related incidents that may not be, or even developing a mind-set in which they perceive incidents of racism that do not exist in reality. The available evidence suggests that these concerns may not be warranted (Williams & Neighbors, 2001). First,

respondents appear to interpret discrimination as intended by researchers, and self-reports of discrimination are consistent with objective experiences. Second, one national study has documented that baseline mental health status (psychological distress and major depression) is unrelated to subsequent reports of discrimination. Third, because reporting discrimination is likely to adversely impact self-esteem and perceptions of control, at least some minority group members are likely to minimize and deny experiences of discrimination. Thus, underreporting may be at least an equally serious threat to the validity of self-reports of discrimination as overreporting. Nevertheless, there is still the need for future research to adjust reports of discrimination for underlying psychological characteristics such as social desirability and neuroticism. Such adjustment strengthens the analytic design and increases the likelihood that observed associations between perceived discrimination and health outcomes might reflect a causal relationship.

At the same time, several strategies that have been used to improve the accuracy of the reporting of stressors should be applied to the study of discrimination as well. These include the use of cues to memory such as visual representations and reminders of personally salient events, wording the questions in ways so as to clearly define the domain of the experience being captured, and using a life-events calendar, which helps to date the onset and resolution of stressors (Williams et al., 2003).

Self-reports of bias also understate the full extent of exposure to discrimination. Given the nature of social interactions, subordinate group members will often lack full knowledge regarding any specific interpersonal transaction (Krieger, 1999). Secondly, and of greater challenge to measure, is the potential that some individuals cope with discrimination by minimizing or even denying its occurrence. Given the potential importance of the phenomenon of denial in research on discrimination and health (Krieger, 1999), future efforts to operationalize it in epidemiological research are a high priority.

Perceived discrimination relies on individual perception and emphasizes the attributions made by the individual. The subjective nature of discrimination and the ambiguity inherent in much interpersonal interaction often leads to uncertainty regarding the attribution of significant incidents of unfair treatment. The attempt to make sense of interracial interactions can stimulate physiological responses (Williams & Neighbors, 2001). The worry and rumination regarding

the causes of experiences of unfair treatment may be a part of the added burden that nondominant group members bear. Future research should assess the degree of ambiguity in the perception of discrimination and examine potential consequences for health.

One approach to reducing the salience of race in assessing discrimination is to first ask respondents if they have been treated “unfairly” in multiple domains of life (Williams, Yu, Jackson, & Andeson, 1997). After respondents have endorsed an experience of unfair treatment, they are asked to attribute a reason. Potential reasons include race and ethnicity, gender, age, religion, and sexual orientation. This approach enables respondents to report on all instances of unfair treatment, but allows the researcher to separate instances attributed to race from those linked to other reasons. Asking repeated questions about “racial discrimination” or experiences “because of your race” could produce demand characteristics in which the respondent believes that it is desirable to the interviewer to report such experiences. This could lead to overreports of discrimination. On the other hand, respondents may vary in their thresholds of what constitutes discrimination and fail to report as discriminatory incidents that were not perceived as very serious.

Information about the stressor of discrimination and its particular context is necessary for determining its impact. Key aspects of discriminatory experiences include the type or domain in which it occurs, the magnitude of the event, the temporal characteristics of the event, and the nature of the relationship between this stressor and other race-related and non-race-related stressors (Cohen et al., 1995). Beliefs about self, such as racial consciousness and identity, might affect the appraisal of discrimination, and other variables, such as social support and feelings of control, could enhance an individual’s capacity to cope and respond to discriminatory experiences.

The assessment of characteristics of discriminatory experiences should also include characteristics of the perpetrator. One study of African Americans found that experiences of discrimination were more strongly related to psychological distress when the perpetrator was also Black than when the perpetrator was White (Mays & Cochran, 1998).

### Understanding the Underlying Processes

One of the most critical research needs is for more careful attention to the specific mechanisms by which

perceptions of discrimination might adversely affect health. The literature on stress and health indicates that stressors can influence physical illness primarily through causing negative emotional states, such as anxiety and depression, which in turn can have direct effects on biological processes or patterns of behavior that affect disease risk (Cohen et al., 1995). It is thus plausible that one of the pathways by which discrimination can affect physical health outcomes may be indirect through psychological distress. That is, discrimination may lead to elevated psychological distress, which, in turn, may lead to chronic physiological arousal of the cardiovascular system. Research also needs to assess the extent to which reports of discrimination and the negative emotional states created by them might lead to health behaviors, such as impaired sleep patterns, decreased physical activity, increased substance use, and consumption of more food than usual, that may ultimately affect disease risk. As noted, some studies found that exposure to discrimination is associated with problem drinking and cigarette smoking. Thus, health-related behaviors should be included in any comprehensive assessment of coping responses to discrimination. Experiences of discrimination and the negative emotional states created by them may also lead to lower levels of compliance with medical recommendations (Cohen et al., 1995). This latter mechanism has not yet been explored in the literature. Researchers should also give attention to assessing the contribution of discrimination not only to the onset of disease but also to its severity and course.

At present, our understanding is limited regarding how exposure to discrimination leads to changes in particular biological responses and health behaviors. Research is needed that would identify the conditions under which particular types of exposure lead through specific processes to affect health. Such research should assess the conditions under which specific physiological systems, such as the cardiovascular, the neuroendocrine, and the immune system, are affected by particular types of exposure to discrimination. We are also largely unaware of the psychological or biological vulnerability factors for discrimination and the extent to which a given race-related stressor can produce varying responses in different individuals or groups. We are also not cognizant of the genetic and psychological factors that can make some organ systems vulnerable to the effects of discrimination on health. In the stress literature, for example, greater genetic vulnerability to depression is associated with



an increased impact of stressful life experiences on major depression (Kessler, 1997).

## CONCLUSION

A growing body of research indicates that discrimination is associated with poor health status, with the association being strongest for mental health. At present, we do not know the extent to which exposure to perceived discrimination leads to increased risk of disease, the conditions under which this might occur, or the mechanisms and processes that might be involved. It is also not clear whether there is a dose response relationship between discrimination and changes in health status. However, the literature offers needed concepts, models, measures, and methods for rigorous and sustained scientific evaluation of the association between perceived discrimination and a broad range of health outcomes.

—David R. Williams

See also CULTURAL FACTORS AND HEALTH; STRESS, APPRAISAL, AND COPING

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## DIVORCE AND HEALTH

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Marriage constitutes one of the most basic human relationships, forming the foundation for family life. Both men and women enjoy a range of benefits from

marriage, including better physical health, mental health, and financial well-being (see Waite & Gallagher, 2000, for a summary). The end of marriage through either death or divorce effectively stops the flow of these benefits to the former spouse(s). But divorce differs from widowhood in key ways. Marital separation and divorce differ primarily in their legal status, rather than in their consequences for the health of the individual, so both are included in the discussion here. Divorce marks the failure of the relationship. It tends to be accompanied by acrimony between spouses (Hopper, 2000) and increased risk of domestic violence (Mazur & Michalek, 1998), leads to often substantial declines in financial well-being, especially for women and dependent children (Petersen, 1996), and declines in social and emotional support (Mirowsky & Ross, 1989). All of these changes might affect physical or emotional health.

## EMOTIONAL HEALTH

Married men and married women show better emotional health than those who are not married, on average (Mirowsky & Ross, 1989). A number of recent studies have attempted to assess the mental health consequences of marriage and divorce and to separate out these from the selection of emotionally healthy individuals into marriage and distressed or unhealthy individuals. These studies followed individuals over time as some marry, some divorce, and some retain their previous marital status. Consistently, transitions into marriage improve mental health, on average, for both men and women, and transitions out of marriage decrease it (Horwitz, Raskin, White, & Howell-White, 1996; Marks & Lambert, 1998; Simon, 2002). It is important to note that although rates of mental illness are quite similar for men and women in the United States today, women show higher rates of affective and anxiety disorders, with symptoms of nonspecific anxiety, distress, and depression, whereas men have higher rates of antisocial personality and substance abuse dependence disorders, which manifest themselves in antisocial behavior and drug and alcohol problems (Kessler et al., 1994).

Robin W. Simon (2002) found that divorce increases symptoms of emotional distress among both women and men, but women show greater increases than men in depressive symptoms following divorce. Both men and women who divorce report a significant increase in alcohol abuse. Simon also found that men

and women who divorced reported more depression and more alcohol problems earlier than those who remained married, which she interprets as both a cause *and* a consequence of disruption.

## PHYSICAL HEALTH AND LONGEVITY

Catherine E. Ross and her colleagues (Ross, Mirowsky, & Goldsteen, 1990) summed up the evidence on the relationship between marital status and longevity: "Compared to married people, the non married . . . have higher rates of mortality than the married: about 50% higher among women and 250% higher among men." The unmarried face especially high mortality rates for causes of death that have a large behavioral component, such as suicide (Smith, Mercy, & Conn, 1988), accidents, lung cancer, and cirrhosis.

Lee A. Lillard and Linda J. Waite (1995) found that divorced men faced chances of dying that were much higher than otherwise similar married men and about the same as those faced by men who were widowed, separated, or never married. The picture was comparable for divorced women, who showed higher chances of dying than married women *or than divorced women*, although never married and separated women fared as poorly as the divorced. The relatively poor health behaviors of divorced and widowed men certainly contribute to their higher mortality (Umberson, 1992). Divorce also seems to contribute to poor health and increased mortality through its effect on physiological functioning (Kiecolt-Glaser et al., 1987). Divorced women also seem to suffer from the reductions in financial well-being that tend to follow from marital disruption (Hahn, 1993; Lillard & Waite, 1995; Petersen, 1996).

## Selection Into and Out of Marriage and Health

Cross-sectional differences in both emotional and physical health between the married and divorced are sizeable, but may result from the selection of the healthy into marriage and the unhealthy out. Many recent studies have addressed this selection by following individuals over time to assess the relationship between *changes* in marital status and *changes* in physical or mental health. These studies consistently find that selection into or out of marriage does not account for the better physical (Lillard & Panis, 1996) or psychological (Horwitz et al., 1996; Marks &

Lambert, 1998; Simon, 2002) health of married men or married women. Something about being married and something about being unmarried affects health.

—Linda J. Waite

See also SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH

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## DOCTOR-PATIENT COMMUNICATION

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The delivery of medical care depends upon effective communication in the doctor-patient relationship. When patients fail to understand what they have been told and do not ask questions or express their true concerns, the medical visit can be compromised. Thirty years of research provides important insights into the challenges of doctor-patient communication and the factors that promote or interfere with the therapeutic relationship.

In human social interaction, effective communication involves the unrestricted exchange of meaning between people to establish a common understanding. This exchange can take various forms: *words* (spoken or written) constitute verbal communication, and *signs* constitute nonverbal communication (gestures, facial expressions, gaze and eye contact, body postures and movements, vocal tone and quality, interaction distance, touch, and appearance). Doctors and patients express their own and read each other's signs constantly (and usually unconsciously) at the same time that they are communicating verbally. People tend to infer the meaning of others' nonverbal cues and draw conclusions, correctly or incorrectly, about others' attributes, personality, behavior, beliefs, and feelings. A doctor might observe a patient's facial expressions of pain and understand what the patient is experiencing. Or the doctor may control or suppress his or her own negative nonverbal messages (e.g., worry, distress) and purposefully express positive signs (e.g., caring, concern) in order to build trust in the therapeutic relationship. In the medical interaction, the sensitivity of doctor and patient to each other's verbal and nonverbal messages strongly affects the success of their communication.

The content of doctor-patient communication tends to fall into two broad categories. *Instrumental* communication is focused on achieving certain goals or tasks (e.g., diagnosis and treatment plan). Doctors inform and educate patients to follow treatment regimens (e.g., take medication) and to accept responsibility for their health behavior (e.g., exercise, quit smoking). Instrumental communication involves seeking and providing information in order to achieve behavioral goals in the medical visit.

The second broad category of communication content is *affective* communication, which focuses primarily on feelings, emotions, and experiences. This affective, or relational, dimension of communication is critical in the building of trust. Particularly when they are ill, patients may be acutely sensitive to their doctor's bedside manner—a common term encompassing a wealth of information about the doctor's sensitivity to and affective communication toward the patient. Patients also attend to doctors' affective responses, such as when they question their doctors' reasoning or conclusions, express dissatisfaction with a therapeutic process or result, explain their noncompliance with a prescribed regimen, negotiate for one they like better, or announce that they intend to get a second opinion.

#### WHAT CAN GO WRONG IN DOCTOR-PATIENT COMMUNICATION?

Doctor-patient communication that is both precise and emotionally supportive is not easy to achieve. Patients and doctors typically have a limited amount of time together and may speak different verbal (and even nonverbal) languages, have different ethnic backgrounds and cultural customs, and hold different views about the illness. When patients are anxious or depressed, they tend to have thought and memory impairments that hamper their accurate reporting of information to their doctors and hinder both their recollection of their doctors' directives and their motivation to comply with them. When doctors use medical terminology, patients tend to be confused but fail to ask questions. Studies show that immediately after their medical visit, patients forget at least a third to as much as half of what their doctors have told them.

Doctors also contribute to communication problems, sometimes not listening well and interrupting patients when they express their concerns. Often, there is little time for detailed and clear explanations.

Of course, affective communication, particularly in the nonverbal channels, can subtly co-occur with the tasks of instrumental and/or affective verbal communication. A doctor's supportive touch on the arm, for example, can be paired with measuring the patient's blood pressure, or an encouraging head nod can be paired with an inquiry into symptoms. Certain other affective messages can be detrimental to the relationship, such as a doctor's nonverbal expression of disinterest (e.g., looking at the chart instead of the patient) or hurry (e.g., checking the watch while standing near and oriented toward the door). Such communication can be very subtle, but it conveys powerful messages to a patient.

Research shows that communication is affected by context. For example, older patients are treated differently than younger patients. Doctors tend to give less attention to the problems and disease burdens of older patients, and doctors are less likely to suggest health promotion and disease prevention regimens when patients are older. Older patients often have another person present at their medical visit (e.g., a relative or caretaker), and the presence of this third person can be helpful but can also disrupt the doctor-patient relationship.

#### THE POSITIVE OUTCOMES OF THERAPEUTIC COMMUNICATION

Effective doctor-patient communication is a valuable goal for several reasons. Patients are most satisfied with doctors who provide clear explanations in terms that they can understand, and who listen to their concerns, answer their questions, and educate them about how best to care for themselves. Patients are most satisfied with relationships that involve partnership with rather than authoritarian control by the doctor, and with a doctor they feel they can trust. Satisfied patients are more likely to remain loyal to their doctor, recommend him or her to others, and refrain from "doctor-shopping" and from initiating a malpractice suit if the outcomes of care are less than expected.

When patients and their doctors communicate effectively, patients are better able to adhere to treatment recommendations. This is a very important goal, because as many as 40% of patients fail to follow their recommended treatment regimens, resulting in billions of wasted health care dollars. Patients are more likely to follow recommendations they fully understand. When patients' and doctors' expectations for

treatment are in synchrony, better health care choices are made and patients remain committed to their choices. When patients and doctors communicate effectively, they can work together to solve problems and overcome barriers to adherence. Good communication allows patients to ask questions of their doctors, express their opinions, ask about their options, and state their preferences. Greater patient participation leads to more informed decision making, greater patient satisfaction, better adherence, and ultimately improved health and quality of life. In the long run, health care costs are reduced.

### HOW CAN EFFECTIVE DOCTOR-PATIENT COMMUNICATION BE ACHIEVED?

Interpersonal communication is a two-way street. Improving doctor-patient communication requires the attention of both individuals in the context of medical care. Doctors can significantly improve their patients' health care outcomes by systematically educating them about the procedures or prescriptions that are being recommended to them, the reasons for these recommendations, the expected benefit to the patient and the likelihood of that benefit, what alternatives exist for treatment, the risks of treatment, and the costs on several dimensions such as money, time, and trouble. (This is a system called PREPARED.) In the recommendation of medication for insomnia, for example, the doctor would tell the patient the exact name of the drug and explain how it works, note the importance of managing the patient's insomnia immediately with medication and then transitioning to behavioral techniques to enhance sleep, the doctor's expectation for how the medication could be expected to help the problem, the alternatives that should also be explored (e.g., reducing caffeine, using relaxation techniques), the risks of the medication (e.g., habituation, dependency, reduced alertness), and the potential expense.

The provision of detailed information with a system such as PREPARED does more than simply educate the patient; it signals to the patient the doctor's interest in being a collaborative partner in the patient's health care, and it builds the therapeutic relationship. As doctor and patient openly discuss the patient's concerns, the patient's attitudes and beliefs emerge. Open discussion of the patient's fears can help the doctor to correct the patient's beliefs and improve adherence to recommendations.

On a practical level, patients can be helped to recall their medical histories during the visit, using verbal supports and prompts to aid memory. During the visit, information materials can be reviewed with and then given to patients, and reminder notes can be written regarding what was discussed, decided, and recommended. Reminder post cards about yearly diagnostic tests (e.g., Pap, mammogram, cholesterol screening) can be sent to patients to improve their adherence to long-term screening recommendations. By building trusting therapeutic relationships, doctors can learn about family and cultural pressures and expectations that affect patients' health behaviors (e.g., food choices, work pressures, family stress), and patient care can be improved significantly by doctors' personal and cultural awareness, sensitivity, openness to discussion, and emotional and practical support. A doctor's focus on open and reciprocal affective and instrumental communication can allow patients' expressions of concern regarding the barriers they face in their care (e.g., the cost in dollars or lost work time, and pressures on child care and other family responsibilities). Without open communication, a doctor may never know that a particular therapy was ineffective for a patient because it was not taken correctly, or that a patient's illness was not diagnosed in its early stages because the patient failed to have a recommended screening test. Open communication also allows for the recognition of patients' treatable emotional symptoms (e.g., anxiety, fear, depression, and hopelessness) and provides reassurance to patients in the context of competent management and referral.

Doctor-patient communication can also be improved with a simple action on the part of the doctor—*listening* to the patient's story. Researchers have recently focused considerable attention on the importance of understanding how a patient conceptualizes illness and suffering in the context of his or her life. Listening requires complete attention on the present interaction with the patient, as well as empathy, non-judgment of the patient, and genuine concern. Long-term management depends upon helping patients to understand the meaning of their illness, to adhere to complex and difficult treatments, and to experience the doctor as a caring and supportive individual.

There are many things that patients themselves can do to improve therapeutic communication with their doctors. When communicating information to their doctors, they can work to be accurate reporters of their own medical and family history by making sure that

they fully understand the questions they are asked by their doctors and by endeavoring to remember and report the answers correctly. They should detail all medications they are taking, with their doses and schedules (by bringing the medication prescription containers, or a written list of their contents, to the medical visit). Studies show that accurate reporting by the patient requires attention, active effort, focus, concentration, and management of distress such as anxiety. Patients should also be prepared to list their concerns and symptoms at the beginning of the medical interaction so that the doctor can create a "problem list" to be dealt with during the visit. The patient should also list any problems that are complicating his or her care, such as excessive stress, marital problems, or feelings of depression, to name a few. Doctors should not be expected to guess the patient's concerns, conditions, or preferences. Effective health care communication requires that a patient make known to the doctor his or her choices regarding outcomes of care and quality of life. In disease treatment, a patient might clarify for the doctor what matters most to him or her (e.g., cognitive clarity versus complete pain eradication, quality of life versus its length). The most productive and effective therapeutic relationships occur when patients alert their doctors if they anticipate having difficulties in adherence (e.g., if they doubt the value of a recommended treatment or are unwilling to accept the side effects of a medication or cannot make recommended lifestyle changes because of family or job constraints). The best outcomes occur when patients work with their doctors to find a treatment they can be committed to and ask for assistance (which can often be provided by ancillary health professionals such as nurses, dieticians, physical therapists, and psychologists).

In receiving and processing information from their doctors, patients can improve their health care outcomes by requesting clarification of words and concepts they do not understand. Studies show that better decisions are made when patients ask questions of their doctors and even politely challenge the logic of medical decisions made on their behalf. Using the procedure of PREPARED, patients can make better medical decisions when they ask about their procedures and prescriptions, the reasons for them, what can be expected from care, the probabilities that their expectations will be met, as well as the alternatives, risks, and expenses of treatment. Better medical decisions can occur in the context of active patient

involvement (rather than passivity) in communication with their doctors.

There are other strategies, as well, for improving communication in the medical therapeutic relationship. Some patients find it helpful to bring a third person to their medical visit (a friend or family member) who can assist them in communicating with the doctor. It is essential that this individual's role and expected involvement be defined and made clear to the doctor at the outset (e.g., "This is my daughter, and she is just going to listen to be sure I do not forget anything" or "This is my wife, and she is going to ask some questions that we have about my condition"). If there are potential language barriers, the patient should ask for (or bring) an interpreter. Finally, for doctor-patient communication to be effective, it is critical for patients to accept responsibility for their health behaviors, such as by following through with methods provided for them (e.g., stress reduction clinics, smoking cessation programs, dietary counseling) and by providing honest assessments of their adherence to treatment recommendations.

Medical training typically does not emphasize doctor-patient communication. A course or two during medical school may touch on doctor-patient interaction in the context of psychiatry or social medicine, but most early medical training emphasizes the physical and life sciences. During the later, clinical years of medical school as well as during internship and residency, training in patient care includes attention to communication. Throughout the United States, residency (postgraduate) training programs in primary care medicine adhere to recent guidelines for emphasis on and evaluation of humanistic communication skills. Communication is learned mostly from mentors, however. In the ideal medical training program, sensitive, caring mentors model instrumental and affective communication that fosters good patient outcomes. In such programs, training is based on the findings from considerable research showing that instrumental tasks in caring for patients are not separable from affective tasks, that verbal and nonverbal messages from doctors are all extremely important to patient outcomes, and that a patient's inner healing requires a supportive, caring, and partnered relationship with his or her doctor.

## CONCLUSION

Research demonstrates that effective doctor-patient communication is indispensable to patient satisfaction,

adherence, and the positive outcomes of medical treatment. Doctor-patient communication can be strongly affected by situational factors such as time limitations, in the context of medical care as well as by characteristics of doctors and patients. Successful patient care can be brought about through doctor sensitivity to the instrumental and affective components of communication, including attentive listening to patients' experiences of their illness, attention to their nonverbal messages of emotion, clarity in the communication of information to patients, and facilitation of their active involvement in their care. Effective communication can be enhanced when patients are active participants in their medical visits, providing accurate information about their medical histories, current treatments, and adherence, and stating their outcome preferences.

—Robin DiMatteo

See also ADHERENCE TO TREATMENT REGIMENS; HEALTH BELIEF MODEL; HEALTH CARE COSTS AND BEHAVIOR; THEORY OF PLANNED BEHAVIOR; THEORY OF REASONED ACTION

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## DRUG ABUSE: BEHAVIORAL TREATMENT

Contemporary psychosocial treatments for drug abuse generally come from two theoretically different positions: the learning model and the disease model. The learning model, which is the focus of this entry, flows mainly from an academic research position. This model rests on scientific evidence that drugs act directly on brain reward systems, much in the same way that primary reinforcers such as food, water, and sex do, to increase the likelihood that drug-taking behavior will be repeated. The learning model also assumes that drug use and abuse are learned patterns of behavior that are influenced by the same general principles of learning as other behaviors. The treatment approaches that have derived from the learning model, called behavioral treatments, call for the development of new ways of behaving on the part of the substance abuser, as well as reorganization of the abuser's physical and social surroundings, to work against tendencies to return to drug use. No drug use or controlled use may be treatment goals, depending on the characteristics and goals of the abuser. Treatment is professionally delivered, typically by individuals with postgraduate academic degrees.

In contrast to the learning model, the disease model assumes that drug abusers are more likely, perhaps because of their genetic makeup, to seek out and use substances to excess and that drug-seeking behavior is outside the control of the user. Treatment calls for admitting powerlessness over drugs or alcohol, and the basic goal of treatment is always total abstinence from all mood-altering substances. Treatment can be obtained from professional counselors, who are often individuals in recovery from substance abuse themselves, and/or from participation in self-help programs like Alcoholics Anonymous (AA) or Narcotics Anonymous (NA), in which substance abusers voluntarily assist each other with recovery efforts.

Although the disease model is highly regarded by clinicians and probably the most common approach to psychosocial treatment of drug abuse in the United States, it has not been widely researched and therefore currently lacks strong scientific support. In contrast, the learning model and behavioral treatments of drug abuse have been relatively well researched and have broad scientific support for their effectiveness. Four

well-known behavioral treatments, each of which has been demonstrated to be effective in controlled studies, are described in more detail in this entry: behavioral counseling/skills training, contingency management, behavioral marital therapy, and multimodal treatments.

## BEHAVIORAL COUNSELING/SKILLS TRAINING

Behavioral counseling/skills training emphasizes rearranging the patient's surroundings and learning specific skills believed to be important for discontinuing harmful drug use and avoiding a return to drug use. Whether the treatment goal is abstinence or moderation of harmful use, patients learn how to identify triggers and consequences of their drug use. For example, if drug use or problematic use is more likely when patients are in a particular place (e.g., bars) or in the company of certain people (e.g., former high school buddies), they are counseled to rearrange their plans to avoid or reduce contact with those places or people. Sometimes the goal might be to change the places in which the patient socializes with a particular person (e.g., get together with a particular friend at a sporting event rather than a bar). Regarding consequences, the individual is counseled to make very clear the negative consequences of drug use and to identify healthy options to the positive consequences that they receive from drug use and intoxication.

Patients often receive coping skills training in areas believed to be important to discontinuing drug use and avoiding a return to drug use. To combat the common problem of social pressure to use drugs, for example, patients are instructed in a step-by-step style in drug-refusal skills through role playing and other exercises. When moderation is the goal with problem drinkers, individuals are taught to monitor their drinking, set drinking limits, and to use specific strategies to limit the amount consumed (e.g., do not drink alcoholic beverages to quench thirst, take small sips, alternate between alcoholic and nonalcoholic drinks) (see Hester & Miller, 1995, chap. 9). Other aspects of social skills training and problem solving are also commonly included in behavioral treatments for drug dependence (Hester & Miller, 1995, chap. 13).

With regard to teaching nondependent, problem drinkers to moderate their intake, a series of experimental studies reported over a 10-year period indicated that 20% to 70% of clinical samples can learn to drink moderately and that those effects can be

sustained for up to 2 years (see Hester & Miller, 1995, chap. 9).

A number of well-controlled treatment-outcome studies also support the effectiveness of skills training in the treatment of alcohol dependence (Hester & Miller, 1995, chaps. 2, 13). Most of these studies have examined the effectiveness of adding social skills training to other treatments, and focused on assertiveness and related social skills. In a seminal study on this topic, for example, 40 adults hospitalized for alcohol dependence were randomly assigned to either (a) an eight-session skills-training group focused on drinking-related problem solving or (b) a control group in which similar topics were discussed but no specific training was provided. During a 1-year follow-up period, the skills group compared to the control group reported an average of fourfold fewer drinks consumed, sixfold fewer days drunk (11 versus 64 days during the 12-month follow-up), and a ninefold reduction in duration of drinking episodes (average of 5 days versus 44 days) (Chaney, O'Leary, & Marlatt, 1978).

The bulk of the evidence supporting the effectiveness of social skills training and other coping skills training has been obtained with alcoholics and problem drinkers, but more limited evidence is also available supporting the effectiveness of this approach with individuals who abuse or are dependent on illegal drugs like cocaine. In addition, numerous reviews and meta-analyses support the effectiveness of this approach for quitting cigarette smoking. Typically, patients are instructed to set a definite quit date, identify and avoid high-risk situations, develop strategies for dealing with urges to smoke, and ask for support in quitting from family and friends. The proportion of patients who successfully quit smoking at 6- or 12-month follow-ups generally increases as the intensity of the treatment increases, with 20% abstinence rates being common and 40% being reported in some early studies with intensive behavioral treatments. Combining behavioral therapy with pharmacological treatments (e.g., nicotine gum or patch) generally increases quit rates above either treatment alone.

## CONTINGENCY MANAGEMENT

Contingency management (CM) is a treatment approach that encourages behavior change by providing positive reinforcement dependent on, or contingent on, meeting treatment goals and withholding



reinforcement or providing punishing consequences when undesirable behavior occurs. While punishment can be effective in some circumstances, positive reinforcement is preferred. CM has been used effectively in the treatment of various forms of drug dependence, including amphetamine, alcohol, cocaine, marijuana, nicotine, and opiate abuse. While punishment can increase drug abstinence, it also increases treatment dropout. Positive reinforcement, on the other hand, reduces both drug use and treatment dropout.

Contingency management involves an agreement or contract that carefully lays out the desired behavior change, how progress in making the behavior change will be monitored, the consequences that will follow success or failure in making the behavior change, and the duration of the contract. Practical details on the development and use of CM interventions can be found in several sources, including Budney and Higgins (1998) and Higgins and Silverman (1999).

The most common use of CM with drug-dependent individuals is to reinforce refraining, or abstaining, from drug use. Numerous studies have shown that providing incentives contingent on objective evidence of abstinence from recent drug use (e.g., negative urine test results) increases future abstinence (see Higgins & Silverman, 1999). Although compelling evidence regarding the effectiveness of CM has been available since the 1970s, interest in this treatment approach was increased substantially by successes achieved with CM in the treatment of cocaine dependence. In a seminal study on that topic, 38 cocaine-dependent adults were randomly assigned to 24 weeks of behavior therapy, including CM, or to drug abuse counseling (Higgins & Silverman, 1999, chap. 2). In the CM condition, vouchers that could be used to purchase retail items such as gym memberships, fishing licenses, and gift certificates to local restaurants were earned by submitting urine specimens that tested negative for cocaine. More than 50% of patients in the CM condition remained in treatment for the recommended 24 weeks and achieved several months of continuous cocaine abstinence, while only 11% of patients in the comparison condition did so. Subsequent studies of CM in the treatment of cocaine dependence repeated those findings and also demonstrated continuing benefits during the year after treatment ended (Higgins, Wong, Badger, Haug Ogden, & Dantona, 2000). These positive results with CM were particularly encouraging because so few other treatment approaches have been shown to be effective with cocaine dependence.

Most typically, but not always, CM is used as one part of a more comprehensive treatment plan. Indeed, CM can be used to improve willingness to follow through with other parts of a treatment plan. For example, CM has been used to improve the likelihood of taking medications among individuals receiving disulfiram (Antabuse) therapy and tuberculosis-exposed drug abusers (Higgins & Silverman, 1999, chaps. 1, 16, respectively). CM can also improve participation in therapy-related activities, such as patients earning vouchers by completing therapy-related activities. The activities might include attending a job interview if the goal was gaining employment, or attending a self-help meeting if the goal was to increase contact with people who support sobriety. Vouchers can be provided when patients submit proof that they have completed a designated therapeutic activity.

CM is also proving to be capable of improving the success of treatment with important special populations of drug abusers. Improving the likelihood of taking medication among those with infectious diseases was noted above. Another special population is the seriously mentally ill who are also drug dependent. CM may be effective in reducing cigarette smoking and cocaine use among individuals with schizophrenia (Higgins & Silverman, 1999, chaps. 2, 5, respectively). CM is an essential component of a multielement treatment that is effective in the treatment of homeless crack and other drug abusers (Higgins & Silverman, 1999, chap. 4). Another special group for whom effective treatments are sorely needed is drug-dependent pregnant women. A voucher-based CM treatment has been demonstrated to significantly increase abstinence from cocaine and heroin use while at the same time increasing work-related skills among pregnant women who were both drug-dependent and chronically unemployed (Silverman et al., 2002). In another effective CM intervention with pregnant women, vouchers delivered contingent on abstinence from cigarette smoking increased quit rates during pregnancy and after delivery (Donatelle, Prows, Champeau, & Hudson, 2000).

## BEHAVIORAL MARITAL THERAPY

Evidence from studies with alcohol-dependent individuals and with individuals dependent on illegal drugs indicates that involving spouses who are not themselves drug abusers in treatment and providing them with behavioral marital therapy can improve the

quality of the relationship and decrease drug use. The evidence is stronger regarding improvements in marital satisfaction than reductions in drug use, but both have been documented in controlled studies. The rationale for involving spouses in treatment is that they can learn skills that may encourage abstinence or moderation; they can learn to avoid engaging in behavior that may start or encourage drug use; and spouses are an important potential source of alternative reinforcement when drug use stops. Two aspects of behavioral marital therapy seem particularly important. First, couples receive training in positive communication skills, such as how to negotiate for changes in each other's behavior that will improve the quality of the relationship. Second, when treatment involves disulfiram therapy for alcohol dependence, spouses are taught how to effectively monitor the taking of the medication.

Results from studies that included behavioral marital therapy in the treatment of problem drinking provide reason for cautious optimism, including three recent well-controlled studies by O'Farrell et al. (Hester & Miller, 1995, chap. 12). One study that included a 2-year follow-up involved 36 couples, in which the husbands had recently begun individual alcoholism treatment and received a prescription for disulfiram. Couples were randomly assigned to (a) a no-marital therapy group, (b) a behavioral marital therapy group, or (c) an interactional couples group. Couples in the behavioral marital therapy group signed a contract regarding the taking of disulfiram, and they received counseling to increase positive family activities and improve communication. Couples in the interactional group primarily shared feelings about their relationship during therapy sessions. Behavioral marital therapy produced better outcomes on marital adjustment ratings than the other conditions, but there were no significant differences in abstinence among the three groups during treatment or follow-up.

A more recent study by this same group suggests that adding sessions at the end of behavioral marital therapy that emphasize relapse prevention can improve outcomes in this treatment approach (Hester & Miller, 1995, chap. 12). Relapse prevention teaches patients skills to recognize high-risk situations for resuming drug use, to use other coping strategies when they find themselves in risky situations, and to apply strategies to prevent full-blown relapse should drug use occur. Fifty-nine couples, defined by the inclusion of an alcoholic husband, were randomly assigned to receive or not receive 15 relapse prevention

sessions upon completion of 5 months of weekly behavioral marital therapy that included a contract for disulfiram compliance. Abstinence improved significantly from levels prior to treatment in both groups, but couples who received the relapse prevention sessions reported significantly greater abstinence and greater use of the disulfiram contract during follow-up than those who did not receive the extra sessions. Improvements in marital satisfaction during follow-up as compared to before treatment also tended to favor the group that received extra sessions.

## MULTIMODAL TREATMENTS

Treatment packages are often put into place that use most of the individual behavioral treatments noted above as parts of a more comprehensive treatment effort, usually for severely dependent individuals. The Community Reinforcement Approach (CRA) is perhaps the best example of a multimodal-behavioral treatment. CRA includes various forms of coping skills and problem-solving training, vocational counseling, marital therapy, social/recreational counseling, and socially monitored disulfiram therapy (see Meyers & Miller, 2001).

In the seminal study examining the efficacy of the CRA treatment for alcohol dependence, 16 males admitted to a state hospital for alcoholism were divided into matched pairs and randomly assigned to receive CRA plus standard hospital care or standard care alone (Meyers & Miller, 2001, chap. 2). Following discharge from the hospital, CRA patients received a tapered schedule of counseling sessions across several months. During a 6-month follow-up period, patients who received CRA reported approximately sixfold to fourteenfold less time drinking, unemployed, away from their families, or institutionalized, compared to control patients. Several of the CRA elements noted above were added in subsequent studies conducted by this same group of investigators as the treatment moved from being an addition to inpatient treatment to a stand-alone, complete treatment that could be delivered in outpatient settings. Findings from these later studies were at least as impressive as in the seminal study (see Meyers & Miller, 2001). CRA has been effectively extended to the treatment of cocaine and opiate dependence (Higgins & Silverman, 1999, chaps. 2, 23, respectively). A contingency management element was added in the extension of CRA to the treatment of

cocaine dependence discussed earlier (Budney & Higgins, 1998).

Another multimodal program related to CRA is Community Reinforcement and Family Training (CRAFT). CRAFT was based on the idea that since family members can make important contributions in other areas of treatment, they can also be influential in helping to get reluctant drug-dependent family members into treatment. Some of CRAFT's basic components include discussing personal safety issues, identifying the situations in which drug abuse occurs, teaching family members how to use positive reinforcement for both the user and themselves, and emphasizing lifestyle changes for the family member.

In a seminal study examining the efficacy of CRAFT procedures for engaging problem drinkers into treatment (Meyers & Miller, 2001, chap. 8), 130 family members were randomly assigned to (a) Al-Anon therapy, which encourages involvement in the 12-step program and to get resistant drinkers to enter formal treatment, (b) a Johnson Institute intervention, which prepared the family member for a confrontational family meeting that led to formal treatment, or (c) the CRAFT approach. The CRAFT approach was significantly more effective in getting reluctant problem drinkers into treatment (64%) as compared with the more commonly used Al-Anon (13%) and Johnson Institute (30%) interventions. A modified CRAFT approach designed to engage illegal drug abusers into treatment has also been preliminarily tested, with promising results (Meyers & Miller, 2001, chap. 8).

Significant progress has been made in the development of effective behavioral treatments for drug abuse. Learning-based treatments emphasizing step-by-step reinforcement of abstinence, positive lifestyle changes, skills training, and participation of significant others in treatment have been shown to be effective treatments, but there is room for improvement with all of these approaches. Careful assessment of the necessary parts, length, and intensity of treatment, as well as more effective transfer into standard clinical practice remain important challenges for behavioral treatments of drug abuse.

—Stephen T. Higgins and Sarah H. Heil

See also ALCOHOL ABUSE AND DEPENDENCY: TREATMENT;  
APPLIED BEHAVIOR ANALYSIS; DRUG ABUSE: PREVENTION;  
DRUG CRAVING; SMOKING AND NICOTINE DEPENDENCE:  
INTERVENTIONS

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## DRUG ABUSE: PREVENTION

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Drug abuse, including tobacco and alcohol abuse, is a major health and social problem in the United States, contributing significantly to both adult and youth morbidity and mortality. The field of drug abuse prevention aims to reduce these morbidities, mortalities, and attendant costs by two means: preventing onset of drug use among youth, and preventing progression to heavy use and abuse among those youth who have already started using drugs. The purpose of this entry is to review effective drug abuse prevention

efforts, issues in prevention, and future directions for research and practice.

## WHAT IS MEANT BY PREVENTION?

Prevention is defined as any program or strategy that has as its goal either delay of onset, delay of progression from lower to higher use prevalence (frequency) or consumption (amount), or decrease in prevalence and consumption of tobacco, alcohol, and other drugs. The majority of prevention strategies are school-based programs for youth. While these programs range from childhood to late adolescence, most start in middle school. This period, corresponding to early adolescence, is marked by an increase in experimentation with tobacco, alcohol, and marijuana. Prevention focuses heavily on deterring use of these drugs, which are referred to as gateway drugs for their temporal, if not causal, relationship to use of other substances later in adolescence and adulthood.

### Types of Prevention

Preventive efforts can be generally cross-categorized by three types. These include approach to drug abuse control (demand vs. supply reduction), level of prevention (universal, selective, indicated), and focus (reducing risk factors vs. promoting protective factors).

Most prevention programs approach drug abuse control through *demand* reduction—that is, changing youth by changing favorable youth attitudes, perceptions, and behaviors related to drug use. Demand reduction programs tend to emphasize both personal and social influences on drug use, and include skills in decision making, resistance, assertiveness, and normative change, among others. Prevention efforts aimed at *supply* reduction efforts, on the other hand, are focused primarily on changing youth supply, availability, or access to drugs. Supply reduction efforts include formal policies and ordinances on restricting youth access to drugs, enforcement, and/or taxation; voluntary restrictions such as vendor agreements not to sell tobacco and alcohol products to youth; and interdiction at borders and points-of-purchase.

Level of prevention refers to the target population. *Primary*, or *universal*, prevention targets whole populations of youth and typically is accomplished through education by teachers or peers in school settings. *Selective* prevention programs are for youth who

exhibit early problem behaviors that are associated with later drug use, including conduct problems, school achievement problems, or family problems of drug use. Selective programs include student assistance programs, parent-child communication and support programs, and tutoring programs. *Indicated* prevention programs focus on youth who are considered at high risk for drug use and already have one or more problem behaviors associated with later use, including truancy, school achievement problems, stealing, gang involvement, and conduct disorder. Prevention at this level is considered early intervention, and includes in-school counseling, outpatient counseling, and court-mandated programs for youth drug offenders.

Focus of prevention refers to the factors that predispose youth to either use drugs (*risk factors*) or not use drugs (*protective factors*). The majority of prevention efforts focus on counteracting risk factors for drug use and teach skills and strategies to resist drug use and avoid drug use environments. Risk factors for drug use and other problem behaviors include school failure, peer pressure, and lack of positive parent-child communication and support. Fewer programs focus on promoting protective factors against drug use, including social bonding, academic competence, support-seeking and communications skills, and general life skills such as decision making. Selecting a program that focuses on risk or protective factors depends largely on the age and level of drug involvement of youth at the point of intervention. For example, young children in elementary school may benefit more from a program that focuses on building protective factors of age-appropriate, prosocial bonding to peers and adults than from a program that teaches them how to refuse a drug use offer, since, for most children, drugs are not yet available. Alternatively, early and mid-adolescents may benefit more from training in skills to resist and avoid drug use offers and opportunities, since the frequency of these opportunities for drug use and practice of drug use resistance skills is higher in these age groups.

### Effective Prevention

Programs that have demonstrated significant delays or reductions in youth drug use are referred to as science- or evidence-based. Effective prevention programs share at least three common features: a basis in *theories of behavior change*, an emphasis on

*counteracting risk factors and promoting protective factors that mediate drug use, and use of strategies that enhance quality of program implementation and impact.* The remainder of this entry concentrates on effective prevention programs and strategies.

## BASIS IN THEORIES OF BEHAVIOR CHANGE

Basing prevention programs on sound theories of behavior change enables researchers to determine whether a program, if effective, changed behavior according to the mechanisms proposed by the (i.e., program mediators) theory or, if ineffective, failed to change behavior because the mechanisms themselves were not implemented or did not change.

Several theories help to explain how counteracting risk factors and promoting protective factors should work to change drug use behavior. For example, *problem behavior theory* posits that adolescents experience transition periods that make them feel vulnerable to peer pressure. Teaching skills such as decision making and resistance is an alternative way to build confidence.

*Expectancy theory* posits that a prevention program that promotes negative rather than positive norms for drug use will help curb drug use experimentation. *Social learning theory* posits that drug use will be prevented to the extent to which youth can be taught to emulate and bond with nondrug-using models for behavior, and practice resistance skills. *Social bonding*, or *social development theory*, suggests that activities to promote bonding to school and home will protect youth against drug use. Finally, *transactional theories* posit that three levels of risk and protection interact to either influence or prevent drug use: intrapersonal, social, and environmental. Prevention programs based on these transactional theories typically employ multiple components that are designed to have long-term synergistic effects.

### Emphasis on Risk and Protective Mediators of Drug Use

Prevention program mediators refer to those variables that are the immediate targets of a prevention program, such as resistance skills, are demonstrated to change as an immediate result of a program, and which in turn can be shown to prevent or decrease drug use behavior. Program mediators usually include skills or strategies to counteract risk and promote

protection. Risk and protective factors have been identified at three levels: the person (intrapersonal cognitions, affect, behavior), the social situation (interpersonal or group norms, attitudes, and behavior), and the environment (organizational, systems, community, or larger influences).

At the *intrapersonal level*, risk factors for drug use include prior use, positive beliefs about use, positive appraisal of the drug use experience, and lower perceived risk or consequences of use contributing to drug use. Counteracting these intrapersonal risk factors in combination and in their social context appears to be critical for achieving change in drug use behavior. Effective programs that counteract risk at this level combine personal beliefs about drug use risk, perceived personal consequences, and decision making specific to avoiding drug use. Programs that promote protective factors may combine personal choice of nondrug use activities, valuing of school achievement, and involvement in nondrug use activities. While most risk reduction and protective programs are universal, a few operate as selective or indicated prevention programs, such as prevention programs in continuation high schools for low-achieving youth and after-school programs for truant youth. Effects of intrapersonal level prevention programs have been shown on changes in program mediators and on school achievement for periods of 1 to 3 years.

At the *social level*, risk factors include exposure to drug use models, access and attachment to users, and positive perceived social norms for use. These prevention programs focus on counteracting social situational risk factors that typically include training in avoidance, peer pressure resistance, and/or assertiveness skills; weighing positive and negative consequences of drug use; and correcting perceived social norms for use. Social-level programs implemented during the elementary school years may focus on bonding with nonusing peers, family, and school. Most social influence programs are considered universal prevention programs because they include whole populations of school-attending youth. Selective or indicated prevention programs have typically focused on social support-seeking and selection of nonuse alternatives along with skills training. With a few exceptions, social influences programs have been effective in delaying and reducing adolescent drug use, for periods of 5 years or more, when compared with either control or standard health education conditions.

*Environmental*-level risk factors include exposure to and positive beliefs about media portrayals of drug use, exposure to drug use environment, access to drugs, low exposure to prevention programs and resources, and positive perceived environmental norms for drug use. Prevention programs that counteract these risk factors may include organizing and empowering community leaders to change drug use, enforce policy, and institutionalize prevention programs and resources. Environmental-level protective factors include positive media coverage of prevention and nonuse messages, financial resources for prevention, and community availability of organized structures, such as coalitions, to promote prevention programs. Programs that address environmental influences have consisted of either mass media programs or campaigns, policy enforcement or policy change intervention, community coalitions or partnerships organized for drug abuse prevention, or a combination. In general, mass media programs have produced small effects on changing attitudes toward drug use and beliefs about consequences and intentions to use drugs in the future. Restricted access policies that involve youth in enforcement, for example, through activism or sting operations, have an effect on decreasing tobacco sales and purchases by youth and may decrease alcohol consumption. Community coalitions tend to show a trend toward decreasing adolescent drug use, but effects are small.

All of these levels of factors interact to affect youth drug use. Comprehensive community-based programs attempt to integrate these factors by including multiple components in combination, for example, a school program with parent, mass media, and/or community organization training. Although it is not clear whether effects are additive or synergistic, the more comprehensive programs, overall, have shown large reductions in use prevalence by youth compared to control conditions (20% to over 60%) that are sustainable for 8 years or more.

### Strategies to Enhance Quality of Program Implementation and Impact

Several factors have been shown to enhance program implementation and impact on youth. The first is the use of standardized training or teaching materials and procedures for program implementers, who may be teachers, peers, counselors, parents, or service agency staff. A typical training session consists of at

least a day of training that follows the same process outlined in social learning theory to train youth: an overview of general principles, modeling, role playing, group discussion with feedback, and extended practice through homework assignments, or initiation of program implementation with observation. The second is the use of social learning theory methods of implementation with youth: Trainer-youth interaction is enhanced, often with the assistance of peer leaders. The third is the use of periodic booster programming. Finally is the set of techniques, settings, or individuals that can extend prevention beyond the program setting, including interactive homework with parents, and agreement to practice prevention skills outside the program setting.

### Diffusion of Effective Programs

Diffusion includes factors that promote *adoption*, quality of *implementation*, and *dissemination*, or the widespread use of a prevention program.

Factors that promote adoption of effective prevention programs include support of a local “champion” (a prominent, positive role model or organization), early positive communication about the program, pre-training of prevention leaders in knowledge about the program, and available resources.

Quality of implementation includes adherence to program materials and procedures as designed, delivery of the full amount of contact hours of programming, and flexibility for “reinvention” (i.e., some tailoring of the program to the specific needs of youth without sacrificing adherence). In addition to the factors noted in the previous section, quality of implementation increases with the availability of trained personnel, and efficient channels, structures, and processes to implement and monitor program delivery.

Dissemination increases to the extent that an existing diffusion network is in place. Additional factors include whether credible community leaders advocate for the program and communicate with each other about the program, master trainers are available to model program implementation, and implementers feel empowered to spread the program.

As with effective prevention programs, most effective diffusion strategies are based on sound theories of behavior change, in this case, change in the behavior of communities, organizations, and community leaders. First among these is *diffusion of innovation theory*, which posits that a prevention program will be

more rapidly adopted if it is considered innovative and advantageous compared to other programs, and is easy to try out, implement, and adapt to existing settings. *Persuasion marketing theory* suggests that a prevention program will be more readily adopted to the extent that more people in a community are made aware of the program, for example, through positive media coverage. *Mass communication and communication network theories* suggest that the spread of positive interpersonal communications about a program from respected community leaders to the public will enhance adoption and implementation of that program. Finally, *organizational development and process theories* posit that coalitions of prevention leaders and implementers, alike, will increase in empowerment and promote implementation and dissemination of a prevention program to the extent that they are structured, have a clear decision-making process, accept responsibility for prevention tasks, and are recognized for their work.

### Settings for Program Delivery and Diffusion

Effective prevention programs are delivered and disseminated across a range of settings. The most effective settings or channels for prevention programming appear to be those that represent major day-to-day influences on youth drug use and drug use prevention. These include the school (teachers), the home (parents), mass media (television and news programmers), community organizations (either existing youth-serving organizations or new organizations developed for the express purpose of drug abuse prevention planning), and local school and community policy settings (school and community leaders). These settings also reflect targets for prevention in addition to youth. For example, parents who are targeted for parent-child communication skills training may increase positive family bonding, which in turn has protective effects on their children's drug use.

### School Programs

Most school programs are demand reduction prevention programs concentrating on universal prevention. Most of these are delivered by teachers, some with assistance of trained peer leaders. Fewer have focused on selective or indicated prevention programs, such as student assistance programs, or group behavioral skills training for failing or truant students.

Overall, school-based prevention programs have shown strong 1- to 3-year effects on monthly use rates of gateway drugs. Evidence-based programs that include more than seven sessions, include parent-child homework, and/or use booster sessions have achieved effects lasting up to 5 years. The magnitude of effect overall appears to be larger than that achieved from school health education programs that include tobacco or drug education, ranging from 20% to 67% net reduction in use compared to 7%. Whether the differences achieved from specific drug prevention programs versus health education are due to differences in teacher training, teacher or student motivation, or program novelty is not clear.

### Parent Programs

There are fewer parent-based and family-based prevention programs compared to school programs, perhaps due to the relatively greater difficulty in achieving large-scale and sustained parent participation in prevention. Evidence-based parent programs include universal, selective, and indicated programs. Few, however, focus solely on parents. Universal prevention programs include those that promote positive parent-child communication and bonding; take-home assignments as part of a middle school prevention program, media programming, or multicomponent community programs; and programs that promote parent involvement in school policy, and prevention support. All of these universal programs have shown relationships between parent participation in prevention and increase in parent-child communication.

Selective parent prevention programs have included those for disadvantaged parents, parents who report or are referred to these programs because of family management problems, and parents of students who exhibit early social or academic learning difficulties. Programs that include and change skills for family management, rule setting, and modeling of supportive behavior toward the child have demonstrated improvement in observed parent-child interactions and social behavior in school.

Indicated programs for parents of children with conduct and attention deficit disorders have focused on increasing positive parent-child interaction and working with educators to maximize child learning in school. Some of these programs had some effects on changing child aggressive behavior and attention in school, although effects on drug use and social and

academic competence vary by baseline problem behavior levels of children, gender, and length of time for effects to appear.

### Mass Media Programs

Evidence-based mass media programs include universal prevention programs targeted at a general adolescent population, advertising campaigns, and small-scale interventions involving exposure of high-risk youth to different types of counter-advertising, and antiuse campaigns aimed at the general youth population. Recent evaluations of national and state campaigns have shown changes in youth attitudes toward and intentions to use drugs. Local antiuse media programs and campaigns are effective in changing youth awareness of drugs, critical thinking about drug use messages, attitudes, and intentions. The magnitude of effect increases if messages are matched to youth preferences, for example, using high stimulus messages with youth who score high on sensation seeking. Media literacy programs that focus on reconfiguring ads and counter-advertising strategies have shown some short-term changes in adolescent attitudes toward drug use, intentions to use, and experimental use.

### Community Programs

Evidence-based community programs encompass skills training conducted in after-school or recreational settings, and community organizing efforts such as coalition development and youth activism. Resistance skills programs conducted in community settings, such as Boys and Girls Clubs, have shown significant short-term decreases in gateway drug use comparable to short-term decreases reported for school-based programs. Other community programs consist mainly of community organization for prevention. Organizational efforts have thus far shown small changes in drug use (usually changes of less than 1% in prevalence) but large changes in community leader prevention planning, participation, and empowerment. An exception is an organization that involves youth activism, which has produced significant changes in youth tobacco and alcohol use.

### Policy Programs

Most effective policy interventions concentrate on tobacco or alcohol policy change at the local level of

community or school. Some policy interventions involve educational programming for teachers, parents, and/or students. These interventions aim to increase awareness, support, implementation, and enforcement of existing policy. Others have involved increasing tobacco or alcohol taxation, restricting youth access to tobacco or alcohol, or youth activism to promote support for community policy. Overall, these policy interventions have shown decreases in adolescent tobacco and alcohol use for 1 to 3 years.

### Comprehensive, Multicomponent Programs

Adding components or multiple modalities to a prevention program may increase its impact, although the mechanism for the increase, for example, whether additional components provide a booster effect or simple repetition of prevention messages, is not well understood. Overall, results of school programs that included one or more additional program components have shown short-term effects on monthly smoking and drug use similar to those of comprehensive school programs that included a large number of sessions and boosters. However, effects of school plus community programs appeared to have a greater range of effects and larger long-term effects on heavier use rates, averaging 8% net reductions.

Combining parent involvement through education or homework with a school program increases effects on parent involvement and youth behavior and parent behavior. Effects of environmental interventions appear to be stronger to the extent that they are combined—for example, a community no-smoking ordinance with youth sting operations and mass media programming. Relative reductions of up to 20% in youth tobacco use prevalence have been achieved by combining community and youth activism to promote restricted access policy and local mass media support. Policy change, in conjunction with a school program, mass media campaign, community activism or organization, or multicomponent community program, has produced significant reductions in youth and young adult tobacco or alcohol use. Overall, multicomponent prevention programs that include a school program appear to have larger, more sustained effects than school programs alone.

A *comprehensive* community-based prevention program attempts to incorporate all the modalities that are hypothesized to affect youth drug use: school, parent, mass media, community organization, and



community policy. Using all modalities, usually in a staggered sequence rather than simultaneously, maintains novelty and interest by a community over the long term, increases the potential to change community social norms for drug use, and generally provides greater dose-response and booster effects than would be expected to occur from single or nonsequenced modality programs.

## ISSUES IN PREVENTION

The field of prevention intervention research is well advanced, with well over 200 published studies, reviews, and meta-analyses. The majority of these have reported the effects of school programs, followed by media and parent programs, community and policy interventions, and last, multicomponent programs and comprehensive community interventions. The number of studies available for each type of programming reflects the greater difficulty, time, and cost of mounting the more complex programs. Also because of these factors, studies that have systematically compared the effects of separate program components are limited. Thus, research on additive and interactive effects of different types of programs and program components is less advanced than studies of effects of separate programs.

In terms of types of prevention, more research has been reported on the effects of universal compared to selective and indicated prevention programs. Overall, the universal programs have been shown to be effective regardless of ethnic, demographic, or geographic factors. Currently, the available research on selective and indicated programs suggests that they are effective with different at-risk groups, whether in rural or urban settings, although there is some variation in effects with boys compared to girls.

The study of factors that promote use of effective prevention programs is relatively recent and is sometimes referred to as moving from science to practice or simply as action or Phase 5 (demonstration/diffusion) research. Identification and subsequent manipulation of these factors in large prevention trials will require greater role identification, cooperation, and mutual planning between researchers and practitioners than has previously occurred. This joint effort may result in reinvention of prevention programs that were originally tested and shown to be effective according to a certain standard. Little is currently known about the parameters of reinvention that will eventually

enhance widespread diffusion of prevention programs. Additional issues are the lack of systematic comparisons of different programs and program components that are assumed to have additive and synergistic effects, and comparisons of change in variables that are hypothesized to mediate program effects in effective prevention programs.

## FUTURE DIRECTIONS IN PREVENTION

Three major areas of prevention research are expanding, results of which are expected to translate into changes in prevention programming. The first is *prescriptive matching* of prevention programs to subpopulations or types of youth. Included in this area are tailoring role plays, messages, and delivery techniques to males versus females, aggressive versus nonaggressive youth, high versus low sensation-seeking youth, and youth from different cultures; and identification of youth who may be at high genetic risk for nicotine or other types of drug addiction, with the long-term goal of developing different prevention strategies for these groups. The second is including in prevention programming strategies to maximize adoption, quality of implementation, and diffusion. Included in this area are drug use epidemiology and prevention training for administrators to increase their knowledge about prevention programs, inclusion of videotapes to supplement in-person implementer training, and testing of alternative prevention training methods such as interactive distance learning through television. The third is the identification and promotion of prevention delivery and management systems that have potential for sustaining evidence-based programs for long periods of time.

## SUMMARY

Overall, the prevention literature indicates that most prevention programs are universal. Fewer programs have been systematically evaluated with high-risk or drug-using youth. Evidence-based programs tend to be based on theories of behavior change, and focus on either counteracting risk factors, promoting protective factors, or both.

Social influences prevention programs overall show the largest effects on youth drug use. Programs aimed at protective factors affect parent-child communication, bonding, and intentions to use drugs. Programs aimed at risk factors affect drug use resistance,

drug use, and intentions. Well-implemented school programs with boosters, as well as multicomponent community programs, appear to have more durable and generalizable effects across substances than other programs. New directions in prevention include matching prevention programs to subgroups of youth, building diffusion strategies into prevention programs, and promoting delivery and management strategies that will sustain prevention programming in field settings over the long term.

—Mary Ann Pentz

See also DRUG ABUSE: BEHAVIORAL TREATMENT; DRUG CRAVING

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## DRUG CRAVING

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There is no indisputable definition of drug craving. Lack of consensus centers on the multiple ways craving is conceptualized, whether craving has one or several meanings, and inconsistencies in measurement. No adequate animal models exist to guide human research. Some argue that it is a uniquely human experience. Craving is often cited as a reason for drug use, but the role of craving in the development of substance use disorders or in predicting relapse is unclear. Yet, orderly, intensity-related increases in drug craving have been found, suggesting that craving is not an all-or-none phenomenon, but rather should be viewed along a motivational continuum similar to drug response. Increased craving for one type of drug may also trigger craving for other drugs of abuse. Drug craving is also linked to increases and decreases in allocation of attention, sensory, perceptual, and memory

resources. A broad range of neurobiological systems have been linked to craving, but a common pathway through which it operates has yet to be identified. Inevitably, this splintering of the essence of drug craving in diverse directions has resulted in disagreement regarding its universal meaning. Thus, this entry provides a brief overview of the main areas of contention.

## MULTIPLE MEANINGS AND MEASURES

Drug craving is often defined as an irresistible urge that triggers use or relapse. However, it has also been described as unpleasant withdrawal symptoms, obsessive thinking about drug use, and wanting to reexperience the effects of a drug. Among clinicians, researchers, and drug users, the term may mean anything ranging from drug urges to liking, wanting, or needing drugs. Typically, craving is measured using one or a few items that tap into a general aspect of craving, such as rating the average intensity of current desire to use drugs on a 100-point scale. Using these measures, there is little distinction between craving and urge. However, discrepancies have been noted between drug craving as "a strong desire" and how users take the word to mean "any desire or urge, even a weak one, to use drugs." Other distinctions include wide variation in the frequency and duration of drug-craving episodes. Thus, there is potential added informational value in determining if drug craving has unique features, similar to irritability and dysphoria being distinct aspects of negative mood. For example, using several items with broader and more meaningful content coverage (multifactorial measures), four distinct aspects of craving for alcohol, cocaine, heroin, marijuana, and tobacco have been found: (1) inability to control use, (2) relief from withdrawal or negative mood, (3) positive benefits of use, and (4) urges and desire coupled with intention and planning to use drugs. Whether these aspects of drug craving are complementary and unique is an open question.

## EXPLANATIONS OF CRAVING

Drug craving can be viewed solely from a learning perspective, based on the notion that stimuli such as people, places, and things associated with drug use can acquire the properties of conditioned triggers (cue-reactivity) through repeated pairings with drug use. But, learning explanations of drug craving have proved inadequate and inconsistent. For one reason,

the sight of a cigarette may elicit responses that are pleasurable (drug-like) or painful (drug-opposite), depending upon whether one has no intention of stopping smoking or is trying to quit. Relief of depressive symptoms (negative reinforcement) does not explain the frequent lack of association between craving and withdrawal. Positive reinforcement (euphoria) fails to account for the fact that craving and use often persist despite enormous negative health consequences of continued drug use, such as increased risk of HIV infection from needle sharing.

Cognitive explanations of drug craving are equally plausible in that cue-reactivity may reflect priming of semantic networks related to users' need states (pleasantness-unpleasantness), a shift of focus from environmental cues to internal thoughts and feelings, or be mediated by a wide range of cognitive processes, including affect, expectations, and efficacy. For example, heart rate acceleration is commonly found during craving processing, which may reflect cognitive interference on concurrent problem solving (drug-use planning activities). Or craving may be associated with the incentive properties of positive outcome expectations ("I will feel better"), such as withdrawal situations in which there is little confidence in the ability to resist drug use. Brain imaging studies in humans support these cognitive explanations. Increases in drug craving have been associated with activation (increased glucose metabolism or blood flow) in the amygdala and anterior cingulate (emotionality), dorso-lateral prefrontal cortex (working memory), and orbitofrontal cortex (compulsive behavior, expectation of rewarding stimuli, and impaired judgment). Thus, drug craving may be associated with a range of difficulties other than drug use, such as reward deficiency syndrome (reduced ability to experience pleasure) or attention problems, including faulty novelty detection or behavioral inhibition deficits. No single explanation accounts for the widespread variation in these findings.

## IMPLICATIONS

The *Diagnostic and Statistical Manual of Mental Disorders (DSM)* defines craving as a strong subjective desire to use drugs, and states that most, if not all, persons with substance dependence crave to readminister drugs. Yet, drug craving is no longer a significant diagnostic indicator in *DSM*. Nevertheless, craving measures are sometimes used to evaluate substance use disorders, and urges and desires are often markers

for pathological use. Most accounts of craving assume there is a meaningful relationship between craving and drug use, but other approaches reject the notion that the motivational properties of urges and desires are necessary conditions for either continued use or relapse. Thus, the concept of craving has merited sufficient attention to be examined in isolation from use. Even the World Health Organization has recommended that evaluating craving reduction should follow strong criteria, because the aim of intervention is the treatment of drug craving, not merely drug use.

In this context, the notion of craving is recognized as a complex, multiply-determined phenomenon that may have cultural, social, and psychosocial dimensions measured optimally by multiple means. For example, drug craving may be influenced by language to the degree that translations have encountered problems in equivalency of meaning, such as the difference among ratings of drug craving taken "right now" and "ahora mismo," "un instante," or "en este momento," each bound to a distinct time frame. Given the level of complexity of the topic, it is not surprising that significant discoveries remain hampered by not having unambiguous measures with which to define craving universally for all commonly abused substances.

—Edward G. Singleton and Stephen J. Heishman

See also ALCOHOL ABUSE AND DEPENDENCE; ALCOHOL ABUSE AND DEPENDENCE: TREATMENT; APPLIED BEHAVIOR ANALYSIS; DRUG ABUSE: BEHAVIORAL TREATMENT; DRUG ABUSE: PREVENTION; ECOLOGICAL MOMENTARY ASSESSMENT; SMOKING AND NICOTINE DEPENDENCE

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## EATING DISORDERS

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Individuals with eating disorders can present a complicated clinical problem to health care providers. Severity can be extreme, with substantial risks to psychosocial and physical functioning. The complex etiology of eating disorders, combined with high rates of relapse for some disorders, have prompted considerable research. This is important, given the high rates in females but also increasing problems in children, males, and ethnic minorities.

This entry reviews the status of work on eating disorders by describing classification, diagnosis, epidemiology, etiology, and treatment. Anorexia nervosa, bulimia nervosa, and binge eating disorder are covered.

### DEFINITION AND DIAGNOSIS

In the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*, four distinct eating disorders (ED) are classified: anorexia nervosa (AN), bulimia nervosa (BN), eating disorder not otherwise specified (ED-NOS), and the research category of binge eating disorder (BED). While some diagnostic features are similar, there are central characteristics of each disorder. *DSM-IV* criteria for each of these disorders are presented in Table 1.

#### Anorexia Nervosa

AN was the first eating disorder on the scene, with diagnostic criteria emerging in the 1970s. AN is

characterized by intense fear of weight gain and obsession with thinness, even when the individual is emaciated. Anorexic behaviors are attempts to decrease food intake through dietary restriction using methods like undereating, fasting, vomiting, and laxative use, or to increase energy expenditure through excessive physical activity. As a consequence, individuals with AN are significantly underweight. Other features often associated with AN (and semistarvation) include depressed affect, loss of sexual interest, withdrawal from social activities, poor interpersonal relationships, perfectionism, low self-esteem, and poor concentration.

Individuals with AN become overwhelmed by concerns about their bodies and immersed in strategies to lose weight or prevent weight gain. Especially salient are extreme restrictive behaviors, such as excessive exercise despite physical injuries, and behaviors that promote the appearance of having eaten food, such as hiding food from others, moving food around on their plate, or preparing elaborate meals for others. These behaviors are motivated by irrational fears of becoming fat. When attempts are made to intervene, individuals with AN may respond with anger, denial, social withdrawal, and manipulative behaviors.

#### Bulimia Nervosa

BN shares similarities to AN such as restrained eating and preoccupation with shape and weight, but individuals maintain a normal body weight, engage in objective binge episodes, and compensate for perceived calorie excess by vomiting, excessive exercise, or use of laxatives or diuretics. A binge is defined as

**Table 1** *DSM-IV Criteria for Anorexia Nervosa, Bulimia Nervosa, Binge Eating Disorder, and Eating Disorder Not Otherwise Specified*

*Anorexia Nervosa*

- A. Refusal to maintain body weight at or above a minimally normal weight for age and height (e.g., weight loss leading to maintenance of body weight less than 85% of that expected; or failure to make expected weight gain during period of growth, leading to body weight less than 85% of that expected).
- B. Intense fear of gaining weight or becoming fat, even though underweight.
- C. Disturbance in the way in which one's body weight or shape is experienced, undue influence of body weight or shape on self-evaluation, or denial of the seriousness of the current low body weight.
- D. In postmenarcheal females, amenorrhea, i.e., the absence of at least three consecutive menstrual cycles. (A woman is considered to have amenorrhea if her periods occur only following hormone, e.g., estrogen, administration.)

*Specify type:*

**Restricting Type:** during the current episode of Anorexia Nervosa, the person has not regularly engaged in binge-eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas)

**Binge-Eating/Purging Type:** during the current episode of Anorexia Nervosa, the person has regularly engaged in binge-eating or purging behavior (i.e., self-induced vomiting or the misuse of laxatives, diuretics, or enemas)

*Bulimia Nervosa*

- A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
  - (1) eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances
  - (2) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)
- B. Recurrent inappropriate compensatory behavior in order to prevent weight gain, such as self-induced vomiting; misuse of laxatives, diuretics, enemas, or other medications; fasting; or excessive exercise.
- C. The binge eating and inappropriate compensatory behaviors both occur, on average, at least twice a week for 3 months.
- D. Self-evaluation is unduly influenced by body shape and weight.
- E. The disturbance does not occur exclusively during episodes of Anorexia Nervosa.

*Specify type:*

**Purging Type:** during the current episode of Bulimia Nervosa, the person has regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas

**Nonpurging Type:** during the current episode of Bulimia Nervosa, the person has used other inappropriate compensatory behaviors, such as fasting or excessive exercise, but has not regularly engaged in self-induced vomiting or the misuse of laxatives, diuretics, or enemas

*Binge Eating Disorder*

- A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:
  - (1) eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time and under similar circumstances
  - (2) a sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)
- B. The binge-eating episodes are associated with three (or more) of the following:
  - (1) eating much more rapidly than normal
  - (2) eating until uncomfortably full
  - (3) eating large amounts of food when not feeling physically hungry
  - (4) eating alone because of being embarrassed by how much one is eating
  - (5) feeling disgusted with oneself, depressed, or very guilty after overeating
- C. Marked distress regarding binge eating is present.
- D. The binge eating occurs, on average, at least 2 days a week for 6 months.
- E. The binge eating is not associated with the regular use of inappropriate compensatory behaviors (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of Anorexia Nervosa or Bulimia Nervosa.

(Continued)

**Table 1** (*Continued*)*Eating Disorder Not Otherwise Specified*

The Eating Disorder Not Otherwise Specified category is for disorders of eating that do not meet the criteria for any specific Eating Disorder. Examples include:

1. For females, all of the criteria for Anorexia Nervosa are met except that the individual has regular menses.
2. All of the criteria for Anorexia Nervosa are met except that, despite significant weight loss, the individual's current weight is in the normal range.
3. All of the criteria for Bulimia Nervosa are met except that the binge eating and inappropriate compensatory mechanisms occur at a frequency of less than twice a week or for a duration of less than 3 months.
4. The regular use of inappropriate compensatory behavior by an individual of normal body weight after eating small amounts of food (e.g., self-induced vomiting after the consumption of 2 cookies).
5. Repeatedly chewing and spitting out, but not swallowing, large amounts of food.
6. Binge-eating disorder: recurrent episodes of binge eating in the absence of the regular use of inappropriate compensatory behaviors characteristic of Bulimia Nervosa.

Note. From American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author. Copyright 1994 by the American Psychiatric Association. Reprinted by permission.

eating an unusually large amount of food given the circumstances, combined with feelings of loss of control.

BN is often described using the binge-purge cycle, in which social pressures on women to be thin lead to preoccupation with food and attempts to control weight through restrained eating. Over time, extreme restriction cannot be maintained and triggers binge eating, with the compensatory purging behaviors emerging to offset the increased food intake. Purging reinforces binge eating by reducing anxiety about weight gain and disrupting learned satiety cues.

Most bulimic episodes occur in private and are often planned; individuals choose a time and place where they can eat binge foods in secret. People typically binge on foods they deny themselves when dieting, most often foods high in fat and sugar. Bulimic episodes may be precipitated by anxiety, fatigue, negative affect, boredom, or food cues. Once this pattern is established, it becomes a self-perpetuating cycle. Features of BN include depression, low self-esteem, and substance use. Approximately 25% of patients with BN have a history of AN.

### Binge Eating Disorder

BED was introduced in the *DSM-IV* as a psychiatric disorder in need of further study. While BED falls in the ED-NOS category of *DSM-IV*, research suggests it should be a separate diagnosis. Binge eating is a central feature of BED, but unlike BN, individuals do not purge. About half of individuals with BED are overweight or obese. Approximately 50% of

individuals with BED report bingeing prior to the onset of dieting, 40% report the reverse, and 10% to 15% begin dieting and bingeing simultaneously. Preliminary work suggests that 2% to 5% of people with BED have a history of AN, and 5% to 10% have a history of BN.

### Eating Disorder Not Otherwise Specified

Atypical eating disorders not meeting criteria for AN or BN are classified as eating disorders not otherwise specified (ED-NOS). A diagnosis of ED-NOS does not suggest subclinical severity or absence of impairment. These atypical eating disorders are typically diagnosed when individuals do not have one or more essential features of an eating disorder. An example would be an individual who meets all criteria for AN but has normal menstrual cycles. Other atypical eating disorders may be less similar in their presentation to AN or BN. This might include psychogenic overeating or vomiting, chronic dietary restraint combined with overexercising, or recurrent binge eating with low levels of purging behaviors.

### EPIDEMIOLOGY

Eating disorders occur primarily in developed, industrialized countries, with young females the most vulnerable population. Although AN and BN have traditionally been described as Western disorders that affect mostly Caucasian women, countries such as Asia, India, and Africa have documented disordered eating patterns. BED may be as prevalent among

African American and Hispanic women as it is among Caucasian women. Racial differences in clinical presentation of BED argue for culturally sensitive assessment.

Both AN and BN typically emerge in adolescence, with few cases beginning in adulthood over age 25. Most individuals present with BED at a later age than AN and BN, with symptoms beginning primarily in adulthood and with a typical age of onset between 30 and 50 years old.

The population prevalence of AN appears to be approximately 0.28% and 1.0% for BN. Although no studies have documented increases in AN in the general population, research in college populations has indicated increased rates of 5% to 15% for eating disorders. As many as 19% of female students report symptoms of BN, but criteria vary widely across studies. It is likely that many more females experience serious eating problems but may not satisfy formal diagnostic criteria. As many as 80% of female college students report binge eating. Community-based research suggests that BED occurs in approximately 2% to 3% of adult populations and 8% of obese populations. Among individuals seeking treatment for weight control, prevalence rates appear much higher and range from 15% to 70%.

Males represent 5% to 10% of eating disorder cases in clinical samples; some studies suggest prevalence rates as high as 10% to 15% in the general population. In contrast to AN and BN, which affect females primarily, BED is more evenly distributed across the genders, with as many as 40% of cases in males.

Children are increasingly displaying symptoms of eating disorders. Childhood-onset eating disorders typically occur between ages 7 and 13, with boys representing 20% to 25% of cases. There are not sufficient data on incidence and prevalence, and it remains uncertain whether children appropriately fit existing diagnostic systems.

## PSYCHOLOGICAL AND MEDICAL CONSEQUENCES

Eating disorders are associated with comorbid psychopathology, lower quality of life, reduced self-esteem, poorer social relationships, and dysfunctional attitudes about shape and weight. About one third of persons with AN have a major depressive disorder currently, and 60% have had depression previously. Anxiety disorders such as obsessive compulsive disorder

and social phobia are as common as depression, and personality disorders are comorbid in approximately 40% of AN cases. BN is also associated with high levels of lifetime (50%) and current (20%) major depressive disorder, substance abuse (25%), and Cluster B and C personality disorders (40%).

Although less is known about comorbidity with BED, it appears that these individuals have higher rates of major depressive disorder (up to 55%), substance use, anxiety disorders, and personality disorders such as histrionic, borderline, and avoidant personality disorder. Research also indicates that people with BED have problems related to perfectionism, ineffectiveness, and low interoceptive awareness.

Adverse medical conditions associated with AN and BN are many, and include osteoporosis, nutritional deficiencies, cardiovascular problems (including congestive heart failure), and poor cognitive function. Because medical complications of eating disorders most often arise from extreme dietary restriction and purging behaviors, there is substantial overlap in the medical consequences of AN and BN.

As a result of inadequate food intake and purging behaviors, common medical complications include serious disturbances of fluid homeostasis and electrolyte abnormalities. Renal electrolyte abnormalities often occur from purging, with the most serious condition being hypokalemia, which may cause cardiac arrhythmias (a primary cause of death from eating disorders) and cardiomyopathy. These consequences are due to potassium depletion from frequent purging. Cardiovascular abnormalities are common in individuals with AN and BN, such as low blood pressure, hypotension, and sudden death due to ventricular arrhythmias. Gastrointestinal complications can also occur, such as esophagitis, gastric dilatation, dyspepsia, and gastroesophageal reflux disease. For individuals with ED who use laxatives, colon problems often surface with symptoms similar to irritable bowel syndrome, as well as colonic dysmotility and poor peristaltic function.

Endocrine abnormalities are frequently found in individuals with AN, and to a smaller degree in those with BN. Dysfunction resulting in the endocrine system can include abnormalities in the hypothalamic-pituitary axes, resulting in irregular menses, hypercortisolism, abnormal thyroid functioning, hypoglycemia, and diabetes mellitus.

More visible signs of an eating disorder are very low weight in AN and dental complications such as



enamel erosion and dry mouth, as well as glandular swelling and calluses of the hand resulting from repeated vomiting. Nonspecific symptoms reported with BN include weakness, fatigue, and tiredness, as well as physical symptoms of swelling hands and feet, abdominal bloating, headache, and nausea. Among those with AN, starvation may frequently result in dry skin, loss of scalp hair, brittle nails, and development of fine facial hair.

Medical conditions associated with BED are primarily related to obesity, as many individuals with BED are obese. The most common diseases associated with obesity include coronary heart disease, hypertension, diabetes, gallbladder disease, some cancers, sleep apnea, and degenerative joint disease.

The medical consequences of eating disorders have serious implications for mortality and morbidity. Mortality rates for AN are significant (approximately 6% per decade of illness). This is the highest mortality rate of any psychiatric disorder in young people, with death resulting from both physical complications and suicide. The crude mortality rate for BN is 0.3%, the lowest of eating disorders.

## ETIOLOGY

Eating disorders have a complex etiology with multiple determinants, including cultural, social, biological, familial, developmental, personality, and cognitive factors. These risk factors are not independent, and the nature of their specific interactions is unclear.

### Causes of Anorexia

#### *Nervosa and Bulimia Nervosa*

##### *Sociocultural Factors*

Eating disorders exist primarily in countries with abundant food and extreme pressure to be lean. Western media perpetuates the importance of thinness, glorifies underweight body types, and encourages unrealistic expectations for female physical attractiveness. Comparisons of blind versus sighted women indicate that visual media, such as the viewing of fashion magazines and television, contributes to negative eating attitudes and body dissatisfaction. Exposure to slim body types increases body dissatisfaction in women. Thus, many women feel distressed about their weight and shape, which leads to dieting.

Peer groups may also perpetuate risk, especially among adolescent females. Peers can exert their

influence by focusing on shared concerns about weight and body shape. Bullying and teasing about weight is also related to body dissatisfaction and eating concerns, especially in preadolescent and early adolescent peer groups.

##### *Psychological Factors*

The comorbidity of depression and anxiety with eating disorders raise questions of sequence. Most studies show that these disorders predate the eating disorder. Furthermore, negative affect appears to mediate the relationship between dieting and binge eating and may also be relevant in the binge-purge cycling of BN. Bingeing may be a way of elevating mood initially, but guilt and shame typically follow. Purging partially eliminates excess calories, but can also relieve negative emotions and reduce tension. This is consistent with reports of BN patients who indicate lower levels of depression and anxiety following the binge-purge occurrence.

Low self-esteem is another general risk factor for psychopathology that increases vulnerability to eating disorders. Self-esteem based on shape and weight is worse among patients with eating disorders. Low self-esteem predicts onset of disordered eating and worse outcome. Self-esteem moderates perfectionism in predicting symptoms of BN, and interventions aimed at increasing self-esteem have reported lowered incidence of eating disorder symptoms at 1-year follow-up.

Personality disorders and substance abuse are commonly associated with eating disorders. Estimates of comorbid personality disorders range from 42% to 75% of cases of eating disorders. BN has been associated with Cluster B and C disorders such as borderline and avoidant personality disorders, and AN with Cluster C disorders such as obsessive-compulsive and avoidant personality disorders. The presence of personality disorders may increase the likelihood of additional mood or substance abuse problems. Substance abuse has been found in 12% to 18% of cases of AN and 30% to 37% of those with BN.

Body dissatisfaction is a central factor because of its association with negative affect, low self-esteem, and dieting. Body dissatisfaction is believed to cause dieting, which is a precursor to binge eating. Many different risk factors for eating disorders may also operate through body dissatisfaction, such as media exposure or peer teasing about weight.

Several cognitive risks are important to eating disorders. Most individuals with ED obsess about eating, weight, and shape. Research shows that three quarters of ED patients are preoccupied with weight and food for more than 3 hours per day, with 50% reporting that they could not control the preoccupation. Perfectionism is a consistent characteristic in people with eating disorders, especially AN (most evident in the need to have perfect appearance).

Certain negative life experiences may join the list of risk factors. Sexual abuse may be one such experience. A number of studies have documented correlations with previous sexual abuse and eating disorders, but it is uncertain whether sexual abuse is a specific risk factor for eating disorders or a more general risk factor for psychopathology.

### *Puberty*

Adolescence involves many physical and psychosocial adjustments. Average body fat in adolescent females increases from 8% to 22%, with fat deposition occurring mainly in the abdomen, thighs, and buttocks. Cultural messages mandate that these body parts be thin, small, and toned, which exacerbates body dissatisfaction in females. The emergence of dating relationships and the need for peer acceptance during puberty may further increase risk for ED, where girls can become vulnerable to dietary restriction and weight control methods to gain acceptance by peers or to feel physically attractive to males.

### *Familial Factors*

Correlational research on family factors suggests that parents may play a role in increasing risk for ED. Research has described the family environment of individuals with ED to include hostility, enmeshment, and abnormal attachments between parents and children. Patients with ED typically report greater parental intrusiveness, control, and criticism, and perceive their parents to have extreme concerns about achievement and appearance.

Maternal influences may be particularly important. Mothers of patients with ED are more likely to criticize their children's weight or shape, encourage them to lose weight, and are themselves more likely to be engaging in eating-disordered behaviors and dieting. Mothers may also increase risk by transmitting cultural values about shape and weight, making direct

comments about their child's weight, and through feeding practices such as using food to control or reward behavior.

Prospective studies are needed to determine the extent to which parental behaviors are causal, and if they are, to separate the effects of children modeling parental behavior from those of parents displaying unhealthy attitudes toward a child's weight and eating.

### *Genetic Risk Factors*

The role of heritable factors in the etiology of ED has received increasing attention, although the particular mechanism of genetic transmission is not clear. Results from family, twin, and molecular genetic studies of AN and BN suggest that genetic effects may play an important role in disordered eating. Family studies have reported as much as a twelvefold increase in the prevalence of these EDs among relatives of individuals with AN and BN compared to controls.

Twin studies have documented strong concordance in monozygotic twins for both AN and BN, with genetic factors accounting for 50% to 80% of the variance. Other research has found that 32% to 72% of variance in eating disorder attitudes (such as body dissatisfaction and weight preoccupation) are attributable to genetics. Molecular genetic research has identified gene markers of the development of AN and BN, with serotonin being highlighted. In particular, levels of 5-hydroxyindoleacetic acid (HT) appear to be increased in patients with ED. The role of serotonin is not clear, and further study is needed to address the involvement of additional neurotransmitter systems in the pathogenesis of ED, such as those affected by dopamine-related genes.

Heritable characteristics of ED may overlap with the genetic transmission of other depressive and anxiety disorders. Because both ED and attitudes related to shape and weight may run in families, research is needed to distinguish the occurrence and impact of these different vulnerability factors.

### *Causes of Binge Eating Disorder*

The risk factors for BED are less clear. BED affects a more heterogeneous population than does AN or BN, and the age of onset occurs later in adulthood. BED affects both women and men, and both Caucasian and minority cultures. It is likely that biological, psychological, and environmental factors

combine to increase risk of developing BED. Because research on risk for BED is still in its infancy, several potential risk factors are described here, although it is premature to conclude that these factors accurately or sufficiently explain etiology.

### *Obesity*

Childhood and adult obesity appear to increase the probability of engaging in dieting, which may in turn increase vulnerability to binge eating. Having a parent who is obese increases the biological risk for obesity.

### *Parental Influences*

Living with obese parents may promote eating habits that increase vulnerability to BED. For example, unhealthy eating habits and sedentary lifestyles of parents may lead children to adopt the same practices. Parental concerns about a child's overweight status can lead to excessive restriction of food intake in which children are not allowed to eat certain foods, which can inadvertently encourage bingeing on these forbidden foods in private.

Affective disorders in parents may also increase vulnerability to BED, especially if parental mental illness negatively affects the parent-child relationship. One study assessed multiple risk factors of BED and found that individuals with BED reported higher levels of lifetime parental depression and parental criticism about weight and shape, and lower parental contact and affection than controls.

### *Weight Cycling*

Dieting appears to be a risk factor for some, but not all, individuals with BED. Some research suggests that there may be two different subtypes of BED: those who begin dieting prior to the disorder and those who binge first. Levels of psychopathology may be higher among those who begin dieting first, but more research is needed to better understand the distinction between these subtypes. There may also be elevated rates of weight cycling (repeated weight losses followed by weight regain) among individuals with BED. Research is needed to determine how to best measure weight cycling and to determine whether objective repeated weight losses and gains, or self-perceptions of repeated dieting attempts, play a stronger role in the etiology of BED.

### *Psychological Factors*

Many studies have documented higher levels of psychopathology in obese binge eaters compared to nonbinge eaters. Disorders that appear to be prevalent in individuals with BED include depression, anxiety, panic disorder, BN, and borderline, histrionic, and avoidant personality disorders. There is insufficient research to determine an accurate prevalence of these forms of psychopathology among individuals with BED. However, there are consistent estimates that rates of affective disorders (primarily major depression) occur in approximately 50% in people with BED. Depression may play a particularly important role as a trigger for or consequence of binge eating. Binge eating may mediate the relationship between obesity and psychopathology, but the nature of this process is not yet clear.

Certain additional personality characteristics have been reported among individuals with BED. Binge eating has been associated with high levels of perfectionism and ineffectiveness, as well as higher levels of depressive cognitive styles.

Medications that cause weight gain may also be important in the development of BED. Although no studies have examined the risk of BED following the use of medication, individuals may become distressed about weight gain and begin dieting, which can then lead to binge eating.

### *Specific Life Events*

Because of the link between increased weight, dietary restraint, and binge eating behaviors, life events that lead to weight gain may play a role in the etiology of BED. The postpartum period may increase vulnerability for BED among women, especially for those who do not lose weight gained during pregnancy. Several studies have documented increased body dissatisfaction, dietary restraint, and concerns about weight and shape in postpartum periods, with some women developing clinical eating disorders. No research has examined rates of BED onset during this time period, which is an important question to address in future work.

Recovery from substance abuse may increase vulnerability to BED. Weight gain is common during such recovery, as individuals may substitute food for discontinued alcohol or drugs to cope with negative affect. No research has addressed this issue, so the frequency of substance abuse recovery leading to BED

has not been documented. Limited work indicates that substance-related disorders may be more common in men than women at risk for BED. Additional research is needed to clarify this finding and to examine other gender differences in risk factors.

## TREATMENT OF EATING DISORDERS

### **Bulimia Nervosa**

Different treatment methods have been evaluated for BN. Cognitive-behavioral therapy (CBT) has been the most extensively studied. It is consistently successful in improving all central features of BN, including reduction in bingeing, purging, dietary restraint, maladaptive cognitions about weight, and associated psychopathology. This treatment aims to normalize eating patterns, identify triggers for bulimic episodes, teach cognitive and behavioral skills to cope with bingeing and purging, and reduce maladaptive thoughts about shape and weight. CBT results in an average of 80% reduction in binge eating and a cessation rate of 40% to 50%, with improvements maintained at a 1-year follow-up.

Interpersonal therapy (IPT) is the only other psychological treatment to show comparable outcomes for BN. IPT was developed as a treatment for clinical depression, and helps patients identify and improve problems with interpersonal relationships. IPT for BN addresses interpersonal events that trigger bingeing and purging episodes. Some research comparing CBT and IPT indicates that IPT may have less effective short-term outcomes than CBT but comparable outcomes at 1-year follow-up. Both CBT and IPT are short-term outpatient treatments that typically involve 15 to 20 individual treatment sessions. Group treatment formats are also common.

Unlike AN and BED, medication treatment may be effective for BN. Evidence from medication trials indicates that antidepressants have the most clinical utility in treatment of BN and are superior to placebo in reducing binge eating, improving mood, and altering concerns about weight and shape. A range of antidepressant drugs can improve symptoms of BN, and there is no indication that certain antidepressants are more effective than others. Although the short-term benefits of antidepressants for BN are well established, their long-term impact is not clear. CBT in combination with medication can be effective and may enhance favorable outcomes compared to CBT alone. Antidepressant

medication may also be helpful for patients who relapse following treatment.

### **Anorexia Nervosa**

In contrast to numerous research studies on treatment for BN, the literature on AN is smaller and inadequate, with few controlled studies. While inpatient hospitalization is required for severely underweight patients, improved outcomes seem to result when treatment strategies are combined, typically including weight restoration with individual and family psychotherapies. Outcomes of controlled studies show little effectiveness of CBT in the treatment of AN. Some behavioral interventions have been effective in promoting short-term weight gain, but CBT does not appear to improve outcomes over alternative forms of treatment. Direct comparisons between CBT and other psychotherapies for AN are needed.

Several controlled trials of family therapy have demonstrated both short- and long-term effectiveness for AN, particularly in adolescents. The focus of this treatment often includes parent-directed refeeding of the adolescent and providing parental support to help the patient reclaim control and independence in his or her life. Research suggests that family therapy may have improved outcomes for individuals with a short history and early onset of AN, but may be of little help to patients with later onset and more severe illness.

There is little consistent evidence that medication helps with AN, despite the numerous psychological and biological problems related to this disorder. There have been few controlled medication trials, and no medication stands above others in improving symptoms. Medication treatment may be more relevant for related clinical features of the disorder, such as severe depression.

A variety of treatments may be required to treat this severe and complex disorder. Outpatient therapy can have high dropout rates, and a large percentage of individuals with AN continue to have disturbed eating and body image following treatment. Follow-up studies suggest that about 44% of patients have good outcomes of weight restoration and return of menses, but many continue to have psychiatric symptoms. Poorer prognosis exists for individuals with lower initial body weight, purging behaviors (especially vomiting), poor response to previous treatments, and disturbed family relationships.

## Binge Eating Disorder

The lack of research on BED leaves much to be known about the effectiveness of specific treatments. Cognitive-behavioral therapy, modified from CBT techniques for BN, has been tested most. Its focus is on changing maladaptive attitudes and behaviors related to binge eating, identifying binge triggers, moderating food intake, addressing negative stereotypes of overweight, and increasing weight control behaviors. In several studies, CBT has resulted in abstinence of binge eating in about 50% of patients, with longer-term research demonstrating efficacy of 60% at 1-year follow-up.

Interpersonal psychotherapy for BED has also been examined. IPT focuses on binge eating as an unhealthy strategy used to cope with negative emotions related to difficulties in interpersonal relationships. This treatment aims to change the interpersonal environment in which the binge eating was established and sustained. Two controlled studies have indicated effectiveness of IPT, and preliminary research suggests that CBT and IPT may have equivalent short- and long-term effects on binge eating and related psychopathology.

As many as two thirds of patients with BED who are treated with CBT or IPT achieve complete remission, but these psychological treatments do not produce weight loss. Another treatment option may be behavioral weight loss treatment (BWL), which results in both reduced binge eating and short-term weight loss. The focus of BWL is weight reduction through increased physical activity, lowered calorie intake, nutrition education, and attitude change. The low cost and amenability to wide dissemination of BWL are desirable, but it is not known whether weight lost is regained in patients with BED treated with BWL.

Few studies have evaluated medication for BED. Studies have demonstrated short-term benefits of antidepressants compared to placebo, but relapse rates appear as frequent with medication as with other psychological treatments. Medication alone may be insufficient to treat BED. Research is needed to test the efficacy of medication in conjunction with psychological treatments and the impact of long-term medication use.

## CONCLUSIONS

Eating disorders are severe, even to the point of being life-threatening. Anorexia nervosa has a significant

mortality rate, and the obesity associated with BED carries substantial risk for diabetes, heart disease, cancer, and other serious diseases. The psychological and social consequences can also be severe and are what typically bring patients with BN and BED to treatment (medical concerns are more often the predominant issue with AN). That the prevalence of these disorders is increasing is a major concern, as is the finding that children, males, and members of minority groups join women in being affected.

Considerable work has been done to identify factors that place individuals at risk for eating disorders. A combination of genetic, psychological, social, and family factors appear to interact in ways that make some individuals particularly vulnerable. Much more research is needed, however, to isolate specific causes.

Great progress has been made in treatments for the eating disorders. Anorexia nervosa remains a very difficult problem, even when combining many forms of treatment, and relapse rates are high. Bulimia nervosa and, to some extent, BED, respond much more readily to existing treatments. While medications have some benefit, the treatment of choice for BN and BED appears to be cognitive-behavioral therapy, with interpersonal psychotherapy also a viable choice. As with most complex clinical problems, prevention might be more effective than treatment in reducing prevalence, but far too little work on prevention has been done.

—Rebecca Puhl and Kelly D. Brownell

See also BULIMIA NERVOSA: TREATMENT

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## ECOLOGICAL MODELS: APPLICATION TO PHYSICAL ACTIVITY

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Ecological models of health promotion emphasize that health behavior is influenced by a variety of variables operating at multiple levels—ranging from intrapersonal factors (e.g., biological, cognitive, motivational) and interpersonal factors (social norms, supports, and networks) to broader sociocultural and organizational influences and macrolevel policy and environmental influences. Ecological models imply that behavior change interventions are more likely to be effective if they operate on multiple levels: combining “downstream” individually oriented interventions with “mainstream” interventions that reach entire populations through work sites, health plans, schools and communities, and “upstream” policy and environmental changes that work at the broadest possible levels to strengthen the norms, supports, and opportunities for healthful behaviors. Ecological models have helped health behavior change researchers understand the need for multilevel broad-spectrum health promotion strategies, and the models have brought the power of environmental and policy interventions working at the institutional, community, and broadest societal levels into sharper focus. Applied successfully to comprehensive tobacco control, ecological models are now being applied to the challenge of raising population levels of physical activity.

Ecological models are especially well suited to understanding the causes of the mass phenomenon of inactive lifestyles and guiding the development of effective strategies for promoting more active living for whole populations. The fact that only 25% of adults in the United States are engaging in the recommended amount of physical activity (i.e., 30 minutes of moderate intensity activities 5 or more days/week or 20 minutes of vigorous activity 3 or more days/week) and nearly half of America's youth are not vigorously active on a regular basis create an urgent need for effective population-level interventions beyond those requiring active decision making by individuals. Physical activity researchers have turned to ecological models because the more commonly used psychosocial models have not led to a thorough understanding of the influences on physical activity or to highly effective intervention strategies. Low levels of physical activity in industrialized nations have been attributed to the cumulative effects that technology (e.g., autodependent transport, more sedentary jobs and recreation) and our built environment have had on engineering physical activity out of daily lives. Ecological models are uniquely able to identify policy and environmental influences with the potential to raise physical activity levels in entire populations and prevent related health problems. In this entry, we focus on the policy and physical environmental levels of influence on physical activity to demonstrate the unique contribution of ecological models.

## CONCEPTS AND RESEARCH FROM THE BEHAVIORAL AND HEALTH SCIENCES

In applying ecological models to physical activity, the earliest work focused on developing hypotheses about specific policy and physical environmental variables that may influence behavior. One major category is the natural environment, consisting of such variables as weather and geography. However, factors related to the built environment attracted greater interest because of the potential to intervene. Behavioral and health scientists have been interested mainly in leisure-time physical activity, so most of the studies focused on recreational environments. A small literature has produced some consistent findings. Access to activity facilities, opportunities for physical activity (such as nearby programs), and aesthetic qualities of neighborhoods (enjoyable scenery) were consistently related to adults' physical activity. There was less

evidence that weather and safety concerns were related to physical activity, but these variables have not been studied often. For children, time spent outdoors and access to play areas were strongly associated with physical activity.

After reviewing the available intervention studies, the CDC Community Preventive Services Task Force concluded there is evidence to support a strong recommendation to create, or enhance access to, places for physical activity, combined with information outreach about these opportunities, as a way to increase physical activity. The interventions reviewed included efforts of work sites and communities to provide greater access to facilities like fitness centers or walking and biking trails.

Characteristics of buildings themselves may be related to physical activity, and it is important to understand such influences because people spend so much time indoors. Many buildings are designed with attractive elevators visible upon entry, but stairwells are hidden and unappealing. Numerous intervention studies have shown that signs promoting stair use or improving the aesthetics of stairwells can increase stair use. The evidence was strong enough for the CDC Community Preventive Services Task Force to recommend the use of "point-of-decision" prompts placed by elevators and escalators to motivate people to use nearby stairs. Other building-related strategies that may increase daily physical activity levels include slowing elevator speed to promote stair use, placing high volume "destinations" like copy centers or cafeterias in locations that require more walking, locating fitness centers within buildings, creating walking trails near buildings, and making wider use of parking lots that are not adjacent to buildings. Although each strategy might make only a small contribution to daily physical activity, they would be steps toward reengineering physical activity back into daily routines.

Policies include laws, regulations, and rules, and they can play multiple roles in influencing physical activity. Policies guide how the built environment is developed, and new policies are required to change most physical environmental variables. Other policies provide incentives or disincentives for physical activity. For example, most employers reimburse work-related travel by car but not by walking or cycling. Still other policies affect access to physical education and physical activity programs. Budgets for recreation departments or physical education are policies that affect access to physical activity programs. The CDC

Community Preventive Services Task Force found evidence to justify a strong recommendation for policies that supported required school physical education classes that increase the amount of time students spend in moderate or vigorous physical activity. Although virtually no health insurance plans in the United States reimburse physicians for counseling patients about physical activity, a small number of plans subsidize their clients who join health clubs, reducing important financial barriers. Organizations or agencies that control policies affecting physical activity resources or programs can be engaged in change efforts.

In summary, behavioral and health science researchers have identified a small number of environmental and policy variables that are related to physical activity, but there are many more hypothesized associations that have not been studied. Intervention studies on promotion of stair use, physical education, and improving access to programs have begun to influence national recommendations regarding the promotion of physical activity.

## CONCEPTS AND RESEARCH FROM NONHEALTH DISCIPLINES

Ecologically based research on physical activity has stimulated new transdisciplinary collaborations, particularly with urban planning and transportation professionals. These partnerships have produced new theoretical formulations and expanded research methodologies. Planners and transportation researchers have been studying how land use, community design, and transportation systems can affect walking and cycling for transportation as alternatives to automobile dependence. This is a different subset of physical activity than typically has been of interest to health scientists.

There is consistent evidence that the design of communities is related to transportation-related physical activity. The concept of the walkable neighborhood has proven useful. Walkable neighborhoods are those in which stores and jobs are located near homes (mixed land use), there is a higher density of residents to support the shops, and streets are on a grid pattern so there are direct routes from place to place (connectivity of streets). Availability of sidewalks, access to mass transit, less motor vehicle traffic, slower traffic speeds, bicycle lanes, and pedestrian signals are additional factors believed to encourage walking and cycling for transportation. Walkable neighborhoods tend to be in central

cities and older parts of towns that were developed before automobile transportation became so dominant. Most suburban neighborhoods are considered low in walkability, because they were designed to accommodate the needs of cars rather than pedestrians. The studies consistently show people do more walking and cycling for transport in walkable neighborhoods compared to less walkable neighborhoods. The difference has been estimated at about 30 minutes of physical activity per week. It will be necessary to change zoning laws (policy) to create more walkable neighborhoods (environment), but such changes could affect physical activity levels of large numbers of people on a relatively permanent basis.

In summary, researchers outside the health and behavioral sciences have shown how community design and transportation systems have created environments that have reduced daily physical activity for many people. Public and private research funders are increasingly setting aside funds to support transdisciplinary research on environments, policies, and physical activity.

## SUMMARY AND CONCLUSIONS

The defining feature of ecological models is the principle of multiple levels of influence on behavior. The vast majority of research has been on the intrapersonal and interpersonal levels of influence on health behaviors, but a rapidly growing literature from several fields demonstrates that many physical-environmental and policy factors are associated with physical activity. Thus, the research shows that only multilevel models are adequate to explain physical activity and lead to the development of effective interventions for increasing physical activity populationwide that have an optimal mix of downstream, mainstream, and upstream approaches. When community environments are made more activity friendly, then individually oriented and organizationally mediated (work site, school, health plan) interventions based on more traditional psychosocial theories and models are likely to be more effective in promoting and maintaining healthful levels of physical activity.

—James F. Sallis and C. Tracy Orleans

See also CARDIOVASCULAR DISEASE PREVENTION;

COMMUNITY-LEVEL INTERVENTIONS; CHURCH-BASED INTERVENTIONS; COMMUNITY COALITIONS; ECOSOCIAL

THEORY; MULTILEVEL METHODS, THEORY, AND ANALYSIS; PHYSICAL ACTIVITY AND HEALTH

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## ECOLOGICAL MOMENTARY ASSESSMENT

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Ecological Momentary Assessment (EMA) is a method used in the health and behavioral sciences to study a range of phenomena as they happen in people's daily lives outside the laboratory setting. EMA is a valued method because it fills a unique niche. It is *Ecological*, involving multiple, immediate reports of subjective experiences (such as well-being, pain), behaviors (smoking), and/or physiological functioning (blood pressure, cortisol levels) as they occur within people's naturalistic environments. In this way, EMA avoids some of the limitations associated with assessing complex phenomena within a typical laboratory environment, such as the lack of generalizability to real-world situations. It is also *Momentary*. Phenomena are recorded as they are happening at a particular moment in time, rather than later from memory. Thus, EMA avoids many of the biases that come with retrospective accounts of experiences (for a discussion of these biases, see Stone, Shiffman, & DeVries, 1999). Finally, EMA is a versatile form of Assessment. It yields multiple reports per person over time, allowing researchers to examine patterns of data at both the individual and group level. In this respect, EMA is well suited to modeling change or covariation of phenomena over time. For example, simultaneous monitoring of people's experiences and their physiological functioning can identify how physical states respond to the stressors of everyday life.

Pioneering early EMA work were psychologists Mihalyi Csikszentmihalyi and colleagues who introduced a method in the late 1970s to investigate the stream of psychological experience in everyday circumstances. This novel approach, termed the Experience Sampling Method (ESM), used electronic pagers to signal people at random times during the day, at which point they completed a questionnaire on their thoughts, feelings, activities, and other measures of optimal experience or "flow." This work led to a number of experience-sampling applications in the field of psychology and, later, the health and medical sciences. Integral to this latter application were technological advances in portable sampling equipment such as lightweight blood pressure cuffs that allowed researchers to investigate the dynamics of physical functioning in everyday life. With these advances, Arthur Stone and Saul Shiffman coined the term

*ecological momentary assessment* to describe the study of all phenomena, both psychological *and* physical, in a situated and momentary fashion. In this way, EMA is a broader term than the Experience Sampling Method, which refers exclusively to the study of experiential phenomena.

EMA is both methodologically and technically challenging. In addition to the standard array of issues that beset any empirical study, EMA brings with it unique design, implementation, and analysis issues. EMA designs vary in the timing and number of signaled reports (see Reis & Gable, 2000, for a thorough discussion of design and analysis issues) as well as the types of portable technology used to obtain reports. Some studies employ inexpensive pagers or watches with programmable alarms that signal participants to complete a paper-and-pencil questionnaire about their psychological events. Other studies use the more expensive palmtop computers or personal data assistants (PDAs), which combine the signaling and recording needs into one system without the need for separate paper-and-pencil questionnaires (also see Feldman, Barrett, & Barrett, 2001). The use of palmtop computers or PDAs has the additional advantage of ensuring that people make their reports when signaled and not later from memory. Studies involving the study of physical functioning, such as blood pressure, require additional devices to measure these states in an ambulatory fashion. Last, because EMA yields large amounts of data, this method often requires extensive management and statistical skills on the part of the researcher. Indeed, EMA data are often analyzed using multilevel modeling procedures that test for patterns within and across participants simultaneously.

EMA is not without its limitations, however. Besides being time- and resource-intensive for both researchers and participants, EMA does not allow full laboratory control over key variables—a condition often necessary to draw causal conclusions. For this reason, EMA is often used as a way to supplement traditional lab-based procedures and gain a more complete picture of a given psychological or physical phenomenon.

Despite methodological and technical challenges, EMA has played an increasingly vital role in the health and behavioral sciences. It has been used to examine questions associated with psychological health, including coping, subjective well-being, and the phenomenology of emotional experience. Evidence

that standard self-report questionnaires can be biased measures of everyday experience bolsters this work. For example, global and retrospective accounts of emotional experiences often reflect people's beliefs or theories about their experiences, and such accounts are often disproportionately influenced by people's current emotional state or by their most salient or recent experiences.

EMA has also been an especially innovative way to examine properties related to physical health (for examples, see Stone, Shiffman, & DeVries, 1999). Applications have included the temporal properties of heart rate or blood pressure and salivary cortisol levels, which, in turn, have provided insight into their effects on cardiovascular disease and stress. EMA also has been used to inform and evaluate the efficacy of clinical interventions and health treatments—a use that is especially relevant in light of evidence questioning the accuracy of people's retrospective accounts of their physical and psychological symptoms. Applications have included assessing interventions to treat respiratory distress, chronic pain, and smoking.

In all, great progress has been made in studies utilizing EMA, garnering strong implications for theory, research, and practice within the physical and psychological health sciences. Given these advances to date, EMA holds much promise as a valuable tool in other research domains.

—Tamlin Conner,

Michele M. Tugade, and Lisa Feldman Barrett

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## ECOSOCIAL THEORY

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Ecosocial theory is an emerging multilevel *theory of disease distribution* that seeks to integrate social and biologic reasoning, along with a dynamic, historical, and ecological perspective, to address population distributions of disease and social inequalities in health. Guided by the question, Who and what drives current and changing patterns of social inequalities in health?, its central focus is on how people literally embody—biologically—social conditions, thereby generating inequitable population distributions of health. Distinguishing features of ecosocial theory include its emphasis on (a) the importance of explicit theoretical frameworks for epidemiological and other public health research and (b) the accountability of public health scientists and practitioners for the frameworks, questions, and data they do—or do not—employ in their daily work.

From an ecosocial perspective, theory is essential to epidemiological and other public research and practice for three reasons (Krieger, 2001a). First, as in any science, theory is what helps us structure our ideas, serving as mental scaffolding for interrelated sets of ideas whose plausibility can be tested by human action and thought. It is what enables us to explain causal connections between specified phenomena within and across specified domains. Second, theory is critical for public health research and practice, because shared observations of disparities in health do not necessarily translate to common understandings of cause. Consider explanations for long-standing racial/ethnic disparities in health: it is theory, not data, that determines whether racism versus “race” is investigated as causing the observed associations. Third, bringing together social and biological constructs to explain population patterns of health, disease, and well-being requires more than simply generating laundry lists of “social” and “biological” risk factors. Also required are multilevel frameworks and methods for

conceptualizing, operationalizing, analyzing, and interpreting social disparities in health in relation to categories reflecting inequitable social relations, including socioeconomic position, gender, race/ethnicity, and sexuality. Social *and* biologic plausibility matter; neither alone is sufficient for evaluating explanations of distributions of disease, disability, and death (Krieger, 2000). Absent theory to illuminate what is missing and to highlight what is thought to be known, coherent explanations cannot be assembled or tested.

First proposed in 1994 (Krieger, 1994), ecosocial theory has helped galvanize renewed attention to the theoretical foundations of explaining social determinants of health. In contrast to dominant individualistic biomedical and lifestyle explanations of *disease causation*, ecosocial theory is a theory of *disease distribution* that seeks to explain *population distributions of health*. Its four core constructs, elaborated below, are embodiment, pathways of embodiment, cumulative interplay of exposure, susceptibility, and resistance across the lifecourse, and accountability and agency (Krieger, 1994, 2001a). Concerned with literal embodiment of adverse social, physical, and biological exposures from conception to death, this framework is well suited for research on population health in general, and social inequalities in health in particular. This is because ecosocial theory (a) draws attention to the combined impact of societal determinants of health, both social and physical, at multiple levels and scales, and in relation to health outcomes spanning from conception to death, (b) encourages research that promotes understanding of and initiatives to address societal responsibility for social inequalities in health, and (c) explicitly recognizes that scientific knowledge and hypotheses are socially situated, and that insights and experiences of affected communities along with the ideas of researchers, past and present, are germane to fruitful scientific inquiry and public health practice.

To aid conceptualization, ecosocial theory employs a visual fractal metaphor of an evolving bush of life intertwined with the scaffolding of society that different core social groups daily reinforce or seek to alter (Krieger, 1994, 2000, 2001a). This fractal metaphor emphasizes the simultaneity of causation at multiple levels and scales, challenging conventional approaches to parsing out “causes” as “proximal” or “distal.” Rather, by drawing on the imagery of fractals—which are recursive structures, repeating and self-similar at

every scale, from micro to macro—ecosocial theory invites analysis of current and changing population patterns of health, disease, and well-being in relation to *each* level of biological, ecological, and social organization (e.g., cell, organ, organism/individual, family, community, population, society, ecosystem) as manifested at *each* and every scale, whether relatively small and fast (e.g., enzyme catalysis) or relatively large and slow (e.g., infection and renewal of the pool of susceptibles for a specified infectious disease). The ultimate goal is to develop epidemiological explanations that account for both persisting and changing distributions—across time and space—of health, disease, and well-being, including social inequalities in health, and generate knowledge useful for promoting social equity in health.

## ECOSOCIAL THEORY: KEY CONSTRUCTS

Several key constructs are important in ecosocial theory:

- *Embodiment*: a concept referring to how we literally incorporate, biologically, the material and social world in which we live, from in utero to death; a corollary is that no aspect of our biology can be understood absent knowledge of history and individual and societal ways of living.
- *Pathways of embodiment*: structured simultaneously by (a) societal arrangements of power, property, and contingent patterns of production, consumption, and reproduction, and (b) constraints and possibilities of our biology, as shaped by our species’ evolutionary history, our ecologic context, and individual histories—that is, trajectories of biologic and social development.
- *Cumulative interplay between exposure, susceptibility, and resistance*: expressed in pathways of embodiment, with each factor and its distribution conceptualized at multiple levels (individual, neighborhood, regional or political jurisdiction, national, international or supranational) and in multiple domains (e.g., home, work, school, other public settings), in relation to relevant ecologic niches, and manifested in processes at multiple scales of time and space.
- *Accountability and agency*: expressed in pathways of and knowledge about embodiment, in relation to institutions (government, business, and public sector),

communities, households, and individuals, and also to accountability and agency of epidemiologists and other scientists for theories used and ignored to explain social inequalities in health; a corollary is that, given likely complementary causal explanations at different scales and levels, epidemiological studies should explicitly name and consider the benefits and limitations of their particular scale and level of analysis.

—Nancy Krieger

See also CULTURAL FACTORS AND HEALTH; DISCRIMINATION AND HEALTH; ECOLOGICAL MODELS: APPLICATION TO PHYSICAL ACTIVITY; HEALTH DISPARITIES; INCOME INEQUALITY AND HEALTH; MULTILEVEL METHODS, THEORY, AND ANALYSIS; SOCIAL CAPITAL AND HEALTH; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; SOCIOECONOMIC STATUS AND HEALTH

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## EFFECT MODIFICATION

The term *effect modification* has been applied to two distinct phenomena. Referring to the first phenomenon, effect modification simply means that some chosen measure of effect varies across levels of background variables. This phenomenon is more precisely termed effect-measure modification (Rothman & Greenland, 1998, chap. 4), and in the statistics literature is more often termed *heterogeneity* or “interaction.” Referring to the second phenomenon, effect modification means that the mechanism of effect differs with background variables, which is known in the biomedical literature as *dependent action* or (again) “interaction.” The two phenomena are sometimes

confused, as reflected by the use of the same terms (*effect modification*, *interaction*) for both, but in fact they have only limited points of contact.

To make the concepts and distinctions precise, suppose we are studying the effects that changes in a variable  $X$  will have on a subsequent variable  $Y$ , in the presence of a background variable  $Z$  that precedes  $X$  and  $Y$ . For example,  $X$  might be a treatment level such as dose or treatment arm,  $Y$  might be a health outcome variable such as life expectancy following treatment, and  $Z$  might be sex (1 = female, 0 = male). To measure effects, write  $Y_x$  for the outcome one would have if administered treatment level  $x$  of  $X$ ; for example, if  $X = 1$  for active treatment,  $X = 0$  for placebo, then  $Y_1$  is the outcome a subject will have if  $X = 1$  is administered and  $Y_0$  is the outcome a subject will have if  $X = 0$  is administered. (The  $Y_x$  are often called *potential outcomes*; see Rubin, 1990, for a history of their use in statistics, Greenland & Brumback, 2002, for a basic review of connection to other causal modeling concepts such as structural equations and path diagrams, and Pearl, 2000, for an advanced treatment.)

A common measure of the effect of changing  $X$  from 0 to 1 on the outcome is the difference  $Y_1 - Y_0$ ; for example, if  $Y$  were life expectancy,  $Y_1 - Y_0$  would be the change in life expectancy. If this difference varied with sex in a systematic fashion, one could say that the difference was modified by sex, or that there was heterogeneity of the difference across sex. Another common measure of effect is the ratio  $Y_1/Y_0$ ; if this ratio varied with sex in a systematic fashion, one could say that the ratio was modified by sex.

For purely algebraic reasons, two measures may be modified in very different ways by the same variable. Furthermore, if both  $X$  and  $Z$  affect  $Y$ , absence of modification of the difference implies modification of the ratio, and vice versa. As a simple example, suppose for the subjects under study,  $Y_1 = 20$  and  $Y_0 = 10$  for all the males, but  $Y_1 = 30$  and  $Y_0 = 15$  for all the females. Then  $Y_1 - Y_0 = 10$  for males but  $Y_1 - Y_0 = 15$  for females, so there is 5-year modification of the difference measure by sex. But suppose we measured the effects by expectancy ratios  $Y_1/Y_0$ , instead of differences. Then  $Y_1/Y_0 = 20/10 = 2$  for males and  $Y_1/Y_0 = 30/15 = 2$  for females as well, so there is no modification of the ratio measure by sex. Consider next an example in which  $Y_1 = 20$  and  $Y_0 = 10$  for all the males, and  $Y_1 = 30$  and  $Y_0 = 20$  for all the females. Then  $Y_1 - Y_0 = 10$  for both males and females, so there is no modification of the difference by sex. But  $Y_1/Y_0 = 20/10 = 2$  for males and

$Y_1/Y_0 = 30/20 = 1.5$  for females, so there is modification of the ratio by sex.

Such illustrations show that one should not in general equate the presence or absence of effect-measure modification to the presence or absence of interactions in the biologic (mechanistic) sense, because effect-measure modification depends entirely on what measure one chooses to examine, whereas the mechanism is the same regardless of that choice. Nonetheless, it is possible to formulate mechanisms of action that imply absence of modification (homogeneity) of a particular measure. For such a mechanism, the observation of heterogeneity in that measure can be taken as evidence against the mechanism (assuming, of course, that the observations are valid). A classic example is the simple "independent action" model for the effect of X and Z on Y, in which subjects affected by changes in X are disjoint from subjects affected by changes in Z (e.g., see Weinberg, 1986). This model implies homogeneity (*absence* of modification by Z) of the average X effect when that effect is measured by the difference in Y; if X and Z both have effects, this homogeneity of the difference forces there to be heterogeneity (modification) of the ratio across Z. For further details of this connection, and the relation of effect modification to concepts of synergy and antagonism, see Greenland and Poole (1988), Greenland (1993), and Rothman and Greenland (1998, chaps. 4, 18).

—Sander Greenland

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## EFFORT-REWARD IMBALANCE

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In general, people aim at reaching a reasonable balance between the resources invested in cooperative activities and the gains received in turn. All major contracts in social life are based on the principle of reciprocity. Rooted in human evolution, reciprocal exchange reinforces trust and the quality of social relationships, thus enhancing positive emotions and a sense of well-being. Conversely, violation of reciprocity threatens social stability and the self-esteem of contributing people. Recurrent experience of failed reciprocity elicits strong negative emotions and associated stress responses, which, in the long run, contribute to illness susceptibility and reduced well-being. The model of effort-reward imbalance has been developed (a) to identify conditions of failed reciprocity in social life, (b) to explain their pervasiveness, and (c) to predict adverse health outcomes of exposure to this type of stressful experience (Siegrist, 1996). Therefore, this model provides a sociological contribution to the study of social determinants of human health and disease. As it can be reliably measured, the model has been tested in a number of epidemiological, clinical, and laboratory investigations. Moreover, based on evidence of its ability to explain elevated risks of stress-related diseases, the model may be useful in guiding activities of disease prevention and health promotion.

## THEORETICAL BACKGROUND

The model of effort-reward imbalance is derived from a more general approach toward analyzing the psychosocial dimension of human health and well-being. It assumes that personal self-regulation conducive to health is largely contingent on successful social exchange as mediated through salient roles. The marital and parental roles, the work role, and the different civic roles offer opportunities of conducting reciprocated activities that matter for people's need fulfillment, including a favorable sense of self-esteem and self-efficacy.

In adult life the work role is of crucial importance in this respect for at least three reasons. First, having a job is normally a prerequisite for a regular income. Level of income determines a wide range of life chances. Second, training for a job and achievement of occupational status are the most important goals of primary and secondary socialization. It is through education, job training, and status acquisition that personal growth and development are realized, that a core social identity outside the family is acquired, and that goal-directed activity in human life is shaped. Third, occupation defines a most important criterion of social stratification in advanced societies. Amount of esteem and social approval in interpersonal life largely depend on the type of job, professional training, and level of occupational achievement. Alternatively, losing a job and being excluded from the labor market are obvious examples of role termination with deleterious effects on self-regulation, on emotional well-being and health. While termination of the work role by exclusion or loss may define the most visible and stressful experience related to occupational life, other constellations of unfavorable social exchange through the work role are often more prevalent and, perhaps, equally stressful. One such constellation has been identified as the lack of reciprocity between efforts spent and rewards received at work. In view of the centrality of work and occupation in adult life, intense and long-lasting effects on disturbed self-regulation, and particularly self-esteem, are expected to occur in this context. For these reasons the model of effort-reward imbalance has been studied primarily with reference to the work role, and most evidence is available in this context. However, more recently, extensions toward measuring nonreciprocal exchange in other core social roles have been developed.

As mentioned, effort at work is spent as a part of a socially organized exchange process to which society at large contributes in terms of rewards. Rewards are distributed by three transmitter systems as scarce resources: money, esteem, and career opportunities. The model of effort-reward imbalance claims that lack of reciprocity between the costs and gains (i.e., high cost/low gain conditions) elicits negative emotions with special propensity to sustained autonomic and neuroendocrine activation. In structural terms, this imbalance results from the fact that the social exchange between employee and employer is based on an incomplete contract that does not specify the full range of detailed obligations and benefits. In

incomplete contracts, assumptions of trust in mutual commitment are made. However, the model defines three conditions that result in recurrent high cost/low gain experience at work. First, the risk of nonreciprocity in exchange is particularly high if employees have no alternative choice in the labor market, if their skills are poor, or if they subscribe to short-term contracts. Second, employees may accept job arrangements that are considered unfair for a certain time for strategic reasons as they tend to improve their chances for career promotion and related rewards at a later stage. This pattern is often observed in early stages of professional careers. Failed success after long-lasting investment is particularly harmful to a person's self-regulation. Third, there are psychological reasons of a continued mismatch between efforts and rewards at work. People characterized by a motivational pattern of excessive work-related overcommitment and a high need for approval may suffer from inappropriate perceptions of demands and their own coping resources more often than their less involved colleagues. Perceptual distortion prevents them from accurately assessing cost-gain relations.

The predictions derived from the model are as follows: First, the components of effort and reward each may contribute to reduced health, but the imbalance between high effort and low reward (nonreciprocity) produces adverse effects on health over and above the effects of single components. It is the mismatch between high cost and low gain that matters most (structural component of the model). Second, a high level of personal commitment (overcommitment) acts as an intrinsic trigger of nonreciprocal exchange through the work role and thus adversely affects health (personal component of the model). Third, if structural and personal components act in concert, the strongest effects on health and well-being are expected to occur.

## CONCEPTUAL DIFFERENCES

It is important to emphasize conceptual differences between this theoretical model and related conceptual approaches toward studying psychosocial stress at work, such as control theory (in particular the demand-control model [Karasek & Theorell, 1990]) and equity theory (Adams, 1963). The demand-control model has been introduced to assess specific features of job task profiles that restrict decision making and learning opportunities. This model does

not include personal coping characteristics, nor does it address more distant labor market conditions, such as career opportunities, forced mobility, earnings, or job security, as is the case with the model of effort-reward imbalance at work. In view of the documented effects on health produced by high demand/low control jobs and by jobs defined by effort-reward imbalance, the study of combined effects of these two complementary models seems promising. Equity theory derived from social psychology posits that any deviation from an expected balance between inputs and outcomes has negative consequences and that judgments on this balance rely on processes of social comparison with a reference group. According to equity theory, receiving too much is considered as detrimental as receiving too little. This proposition clearly differs from the model of effort-reward imbalance where inappropriately low gain only matters for adverse outcomes. This conclusion is in accordance with evidence derived from neuroscience research showing that affective responses are faster and stronger to proximate negative events than to positive ones. A further substantial difference between equity theory and the model of effort-reward imbalance concerns the latter's foundation in sociological role theory.

### Measurements

The measurement of the model of effort-reward imbalance at work is largely restricted to self-report data, first, because it combines descriptive and evaluative information on perceived demands (effort) and rewards and, second, because it requires information on personal coping characteristics (overcommitment). Moreover, information on more distant working conditions can hardly be collected by objective measures. Thus, assessment of effort-reward imbalance at work relies on indicators that are measured by psychometric scales containing Likert-scaled items. Essentially, three psychometric scales are measured (effort, reward, overcommitment), and the combination of information from these scales, according to a predefined algorithm, provides an opportunity of measuring the underlying construct. In its most economic version, the standardized questionnaire contains 23 items, with 6 items measuring effort, 11 items measuring rewards, and 6 items measuring overcommitment (short version). The unidimensionality of each scale has been confirmed in several studies, and acceptable internal consistency ranging from about

0.70 to about 0.90 was found. To test the main assumption, a ratio of the sum score of the effort scale and of the sum score of the reward scale is computed, adjusting for different numbers of items in the numerator and denominator. The construction of this ratio serves as an approximate estimate of the imbalance between costs and gains experienced in everyday working life. Scoring high on this ratio (e.g., belonging to the upper quartile of the score distribution) is expected to predict an increased risk of disease. Scoring high on the scale overcommitment is also expected to increase the risk of illness, but especially so in combination with the ratio. Additional ways of measuring the imbalance between effort and reward have been suggested, and alternative ways of modeling associations of these variables with health outcomes are being explored, but the ones summarized here reflect agreed-upon and widely used procedures.

### Importance for Health

Prospective observational studies of large cohorts of initially healthy men and women are considered a gold standard for testing a possible causal role of psychosocial conditions, such as effort-reward imbalance, in health and disease. In addition, experimental evidence and information derived from intervention studies are crucial. Valuable, although methodologically less convincing data are derived from case-control studies and from cross-sectional epidemiological investigations. At least 4 prospective and 2 semi-prospective studies, some 20 cross-sectional or case-control studies, and 2 experimental and 2 intervention studies, have tested the model so far. In many investigations, coronary heart disease or established cardiovascular risk factors, such as hypertension, elevated blood lipids, high level of fibrinogen, cigarette smoking, and alcohol dependence, were analyzed using multivariate logistic regression analysis.

In general, the relative risk (or odds ratio) of suffering from one of these health conditions is increased by 50% to 150% in men and women characterized by effort-reward imbalance, compared to those who are free from this type of stress at work. One line of evidence on these associations comes from the well-known Whitehall II study in the United Kingdom where 10,308 men and women were followed over a mean 5.3 years. As the original questionnaire measuring effort-reward imbalance was not part of the initial screening, but was

included at a later stage, proxy measures were derived for risk estimation. After 5 years, men and women suffering from effort-reward imbalance at work had a 2.2-fold increased risk of exhibiting coronary heart disease compared to nonstressed employees. This result was obtained after controlling for a large number of potentially confounding factors (Marmot, Theorell, & Siegrist, 2002). Most recent information indicates that this association, although attenuated, still persisted 11 years after initial screening. The Whitehall II study is especially important because it documents associations of effort-reward imbalance with additional health measures, in particular, mild-to-moderate psychiatric disorders, alcohol dependence, and reduced physical, mental, and social functioning. Interestingly, adverse effects on health produced by nonreciprocal exchange at work were also found in studies in China and Japan, indicating that the validity of the model is not restricted to Western societies.

A different line of evidence concerns laboratory studies exploring psychobiologic pathways that may underlie the association of occupational stress with bodily dysfunction and disease. In a Dutch study, ambulatory blood pressure and heart rate monitoring on 3 days of a work week was conducted in male employees of a computer company. The group with high scores of the effort/reward ratio exhibited significantly higher mean systolic blood pressure and heart rate values compared to the group without occupational stress. Moreover, mean heart rate variability was lower among stressed employees (Vrijkotte, van Doornen, & de Geus, 2000). Poor self-rated health is considered a meaningful indicator of ill health, as it has been associated with an elevated risk of mortality in many studies. Prospective and cross-sectional evidence is now available indicating a higher probability of poor self-rated health in women and men defined by effort-reward imbalance at work. These associations were found to be particularly strong in populations living in Central and Eastern Europe, a region that has recently witnessed profound socioeconomic threats and changes. Although the construct of effort-reward imbalance has been used as a variable predicting health outcomes, it may also be considered a dependent variable in studies dealing with differences or changes in work organization or in studies comparing organizational justice.

## Importance for Aging

The relevance of nonreciprocal exchange is not restricted to the working life. The work/nonwork interface is important, as negative spillover from work to family life and vice versa may aggravate stressful experience and its adverse consequences for health. Alternatively, favorable conditions outside work can buffer stress reactions that were generated in occupational life. The importance of the model of effort-reward imbalance for aging is illustrated at two levels. First, a cumulation of social reward deficiency experienced in different important roles in midlife is expected to accelerate aging processes in the organism along with an increased illness susceptibility. This is best explained by the free radical theory of aging. Under conditions of chronic psychosocial stress, metabolism in the body is increased. As a consequence, the production of free radicals is enhanced that damage lipids, proteins, and the DNA. Enhanced endogenous oxidation is a major contributor to accelerated aging and degenerative diseases associated with aging.

At a second level, the balance between effort and reward may be important in promoting health and well-being in early old age. Early old age defines a life stage (ranging from about 60 to about 80 years) where opportunities of social productivity and of successful material and psychological need fulfillment through social exchange are limited. This is the case despite the fact that a high proportion of people living in their early old age function well and are indeed motivated to contribute and to perform. Society at large has not yet responded to the challenge of providing a variety of social roles to this growing proportion of the population. It is concluded from this theoretical framework that healthy aging in early old age is greatly enhanced if people are offered social roles that enable them to continue their favorable experience of self-efficacy, self-esteem, and belonging. It is through continued exposure to a controllable challenge and to positive feedback from significant others to one's achievement that a sense of mastery, of worth, and of meaning is reinforced, and that one's motivation and energy are mobilized. These social roles in early old age may include work arrangements beyond traditional retirement age and new forms of social productivity, such as voluntary work, honorary offices, or membership in civic associations and networks.



## Intervention and Policy Implications

The model of effort-reward imbalance at work is useful in designing work site stress prevention and health promotion programs. As a first step, stressful conditions at work can be measured in a standardized way, using psychometrically validated questionnaires that are available in a number of languages. Therefore, the amount of work stress can be assessed for different occupational groups, departments, or organizations. As a second step, intervention measures can be derived from the model at the personal/interpersonal level and at the structural level. At the personal/interpersonal level, techniques of stress management, including stress inoculation through strengthening of psychological and interpersonal resources, are indicated. In order to be effective, these techniques need to address cognitions, attitudes, and job-related motivations in addition to the rather nonspecific relaxation techniques. In one such interventional approach that was conducted in a group of highly stressed inner-city bus drivers, expert-guided group work addressed the coping pattern of work-related overcommitment. After twelve 2-hour sessions, a highly significant decrease in mean level of overcommitment was observed in the intervention group compared to a control group, and this effect remained stable over a 3-month follow-up period. Improved self-observation and perception of arousal, coping with anger, and reinforced self-reliance were important elements of this intervention (Dunham, 2001). Another application of stress prevention at the interpersonal level concerns the improvement of leadership skills among supervisors and superiors, in particular the awareness of an important role of esteem, recognition, and appropriate feedback, as indicated by the model of effort-reward imbalance. Structural measures of work site health promotion derived from the model include the implementation of models of gain-sharing and of nonmonetary incentives, including options of flexible work time arrangements, comparatively high compensation contingent on performance, tailoring of promotion prospects and status according to achievements, improved job security, and further measures of organizational justice.

Obviously, opportunities for structural measures are limited under the constraints of economic globalization. Moreover, technological progress and changes in the labor market reduce the options of organization-based stress prevention. Extension of homework and virtual organizations and a growing proportion of

self-employed people, freelancers, and small teams are examples of these developments. In addition, short-term or part-time contracts and high turnover rates within organizations, rapid technological changes, and instability in the face of merging and downsizing of companies aggravate the situation. Yet, as an important study from the Harvard Business School documented, distinct structural measures aiming at the creation of healthy workplaces (in terms of models such as demand-control and effort-reward imbalance) produce economic benefits as well. These measures include employment security, selective hiring of new personnel, decentralization of decision making, adequate compensation, and extensive training of employees, among others (Pfeffer, 1998). Policy implications of the model of effort-reward imbalance are not restricted to occupational life, but may be extended to the design of voluntary work and to ways of improving social capital within communities.

In summary, effort-reward imbalance in core social roles in adult life is now considered a significant risk factor for the development of stress-related diseases and ill health, in particular coronary heart disease, depression, some forms of addiction, and poor self-rated health. Current evidence indicates that adverse effects on health are prevalent among men and women in midlife and early old life, and that these effects are not restricted to modern Western societies. The ubiquity and intensity of stressful experience elicited by failed reciprocity points to the evolutionary significance of this norm of social exchange. It will be an important scientific task to explore the pathways leading from conditions of social reward deficiency to stress-related diseases, with a particular focus on the brain's reward system (Siegrist, 2000). A different future task concerns the extension of intervention studies that examine the potentially beneficial effects of reducing the imbalance between effort and reward in social roles, most importantly in the work role. So far, this model evolving from interdisciplinary research in medical sociology has documented its scientific value. It remains to be seen how far this new scientific evidence can be transferred into health-promoting policy measures that diminish the burden of societal stress.

—Johannes Siegrist

See also JOB STRAIN AND HEALTH; STRESS, APPRAISAL, AND COPING; SUCCESSFUL AGING; WORK-RELATED STRESS AND HEALTH

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## EMOTIONS: NEGATIVE EMOTIONS AND HEALTH

From Greek and Roman antiquity to modern times, the belief that emotions affect physical health has pervaded popular culture and scientific theory. Recent technological advances have helped elucidate the physiological correlates of negative emotions, and, in combination with a growing body of epidemiological research, suggest that the role of negative emotions in health is more than medical folklore. The current entry provides an overview of the research relating negative emotions to health, focusing on the broadly defined constructs of depression, anxiety, and anger. The content focuses on the influence of negative emotions in the development and course of disease, as opposed to the reverse pathway from disease to emotion, although in reality the relationship is no doubt bidirectional. The entry begins by providing a brief historical perspective on the function of emotions in health, followed by a discussion of definitions and

conceptualization of terms in emotion research. An overview of possible mechanisms underlying the association of negative emotions with health is then provided. Findings from research connecting negative emotions with the etiology and course of chronic and acute disease processes are then summarized. The entry concludes with a discussion of future directions, focusing on factors that may help explain the circumstances under which negative emotions are most likely to impact health.

## HISTORICAL PERSPECTIVE

The belief that emotions can affect health has had a principal influence on medicine for centuries. As the field of medicine emerged, Hippocrates (ca. 460–ca. 370 B.C.) and his successors proposed the existence of four distinct “humors” (black bile, yellow bile, phlegm, and blood). Humors were viewed as direct causes of temperament and emotions, and their imbalance was believed to foster disease. Centuries later, this ideology was expanded by the Greek physician Galen (A.D. 131-201), who proposed that strong emotions represented direct and specific causes of disease, which must be kept in equilibrium to sustain mental and physical health.

The specificity ideology (i.e., the tenet that specific emotions foster specific disease processes) remained a dominant perspective through the inception of psychosomatic medicine in the 1930s, as illustrated in the work of Flandaers Dunbar and Franz Alexander. In an attempt to integrate then current models of psychodynamic psychopathology and physiology, these researchers proposed that unresolved psychic wishes and desires created emotional conflicts, associated physiological responses, and subsequently, diseases in related body systems. For example, repression of aggressive affect and resultant anxiety were believed to underlie essential hypertension. The impact of this theoretical perspective was limited, due to important methodological flaws characteristic of the work. Thus, as psychology moved away from psychodynamic schools of thought, models of emotion and health began to emphasize conscious processes and objective circumstances. At the same time, key advances concerning the physiological stress response were contributed by researchers such as Walter Cannon, and later, Hans Seyle. Seyle’s many texts and articles, in particular, had a marked influence on the growing field of psychosomatic medicine and on

popular culture in the mid-20th century. These developments harkened the abandonment of the specificity model and heralded the modern focus on the roles of stress, emotions, and related processes in verifiable health outcomes.

Until recently, science has lacked the technology to support or refute the centuries-old belief that emotions influence health and disease. However, the past decades have seen striking accomplishments in laboratory technologies, in combination with findings from a number of large-scale, methodologically rigorous studies relating emotions to morbidity (i.e., illness and disability) and mortality (i.e., death) in community and clinical populations. Mounting evidence now suggests that negative emotions have a significant influence on health, and that this association proceeds through a number of behavioral and physiological pathways.

## DEFINITIONS AND DISTINCTIONS IN EMOTION RESEARCH

What is meant by the term *emotion*? Conceptualizations articulated in the scientific literature have varied widely, but emotions are generally thought to comprise subjective feelings, reflecting appraisals (i.e., cognition) regarding a stimulus, and accompanied by behavioral impulses and neurobiological alterations that prepare the body for action. Hence, emotions encompass closely related affective, cognitive, behavioral, and physiological processes.

Most theoretical perspectives also share the notion that all emotions, whether “positive” or “negative,” are adaptive inasmuch as they serve a communicative function. Emotions signal a homeostatic imbalance, or need, to the individual, and they also provide information to others in the social environment. Hence, fear signals a threat and encourages actions that would allow elusion of danger. Anger provides an indication to others that the displayer may behave in an aggressive manner. Notwithstanding their intrinsic adaptive value, emotions have the potential to become harmful when they are inappropriate to the situation, or excessive in frequency, strength, and duration.

Although they are often used interchangeably, a distinction should be formed between the terms *emotion* and *mood*. Most generally, emotions describe brief, intense affective experiences that typically have identifiable targets or precipitants, whereas moods

tend to be more enduring, less intense, and less specific in derivation. On the other hand, moods and emotions are typically closely and jointly related. For example, an individual who is in a depressed mood may have a relatively low threshold for experiencing sadness; likewise, experiences that stimulate sadness may precipitate a long-lasting depressed mood. A further distinction can be made between trait affect (i.e., emotions or moods) and state affect. State affects refer to discrete emotional experiences, whereas trait affects reflect the dispositional tendency to experience particular emotions or moods across situations and time. These differences are important, because a basic understanding of physiology suggests that emotions must be enduring or repetitive in nature to contribute to the development and progression of chronic diseases. On the other hand, intense bursts of negative affect could trigger acute health events in individuals with underlying disease.

Finally, some researchers assert that emotions can be distinguished according to the underlying dimensions of valence (i.e., whether they are positive or negative) and arousal (i.e., whether they reflect high or low engagement and attention). Emotions that are similar in terms of valence or arousal often cluster, or co-occur. This entry focuses specifically on emotions of negative valence, and varying levels of arousal, which have been examined with some methodological rigor and frequency in relation to verifiable health outcomes, namely depression, anxiety, and anger. (For a discussion of positive emotions and health, see Emotions: Positive Emotions and Health, this volume.)

## How Might Negative Emotions Affect Health?

Recent scientific achievements have hastened substantial changes from the specificity approach to the current understanding of the roles of emotions in health. Contemporary perspectives acknowledge that many emotions may affect diverse health outcomes, and that the connection from emotions to disease is likely to proceed through multiple pathways. The influence of negative emotions may occur indirectly, through health behaviors or nonadherence to proscribed medical regimens, and it may also proceed directly through physiological pathways. In respect to the latter, recent research has begun to elucidate the physiological correlates of emotions, which appear to involve alterations in cardiovascular, neuroendocrine, and immune system functioning.

### *Indirect Pathways*

As reviewed by Kiecolt-Glaser, McGuire, Robles, and Glaser (2002) and Tracy Mayne (1999), research has shown that distressed individuals tend to engage in unhealthy behaviors such as smoking, leading a sedentary lifestyle, eating poorly, obtaining limited or disturbed sleep, and using alcohol and drugs. These habits are often interrelated (e.g., use of alcohol and drugs typically abets disturbed sleep), and they may lead to further emotional disturbances, creating cyclic and repetitive influences on health. Additional research suggests that once illness occurs, emotionally distressed individuals are less likely to adhere to lifestyle changes and medication regimens prescribed by health care providers, relative to their nondistressed counterparts. Thus, behavioral pathways may contribute to the association between negative emotions and outcomes in clinically ill populations. In part, this association may reflect the fact that individuals with higher levels of negative emotions tend to report lower levels of control, or “self-efficacy,” over their health and environments. Having a strong sense of self-efficacy has been shown to be strongly predictive of engaging in health-promoting behaviors and avoiding health-damaging behaviors. Moreover, negative health practices such as smoking or consumption of substances may represent maladaptive attempts to cope with, or manage, feelings of distress.

### *Direct Pathways*

Studies that have examined health practices suggest that they do not account completely for associations between negative emotions and health. Consistently, research suggests that negative emotions engender physiological changes that, in turn, have been shown to predict worse health outcomes. As alluded to previously, emotions are typically accompanied by behavioral impulses—that is, to fight or flee in the case of anxiety and anger, and to withdraw from the environment and conserve energy when experiencing depression. Physiological alterations occur that would facilitate enactment of these behaviors, which can be viewed as adaptive in this regard. However, emotional activation that is incongruent with environmental demands (i.e., when emotion is inappropriate or excessive in intensity, duration, or frequency) may overtax the system, leading to disease vulnerability.

As summarized in detailed reviews by Kiecolt-Glaser and colleagues (2002) and Mayne (1999),

negative emotions have been linked to hyperactivity of the sympathetic-adrenal medullary (SAM) system and alterations in the hypothalamic-pituitary-adrenocortical (HPA) axis. Activation of these systems prompts the release of stress hormones (e.g., catecholamines, cortisol) and promotes increases in cardiovascular responses (e.g., blood pressure, heart rate). When enacted repetitively over time, these alterations are believed to contribute to the etiology and course of cardiovascular diseases (CVD) by hastening atherosclerosis (i.e., the buildup of fats and other substances in the arteries, which underlies the clinical manifestations of heart disease) and increasing vulnerability to clinical events in patients with atherosclerosis. Additional evidence suggests that negative emotions and attitudes affect immune functioning and, through this pathway, might relate to additional outcomes, such as infectious diseases, autoimmune disorders, cancer, and atherosclerosis. Most important, current understanding of the roles of these physiological alternations in illness—and of the nature of the effects of negative emotions on these processes—is incomplete; further research is clearly warranted. Nonetheless, growing evidence suggests that the link between negative emotions and health proceeds, at least in part, through physiological channels.

As implied by the above discussion, the degree to which negative emotions display similar or distinct physiological correlates is currently unclear. Negative emotions often occur concomitantly, creating difficulty in isolating their discrete effects. However, as noted by Kubzansky and Kawachi (2000), effects may differ due to the nature of behavioral coping processes associated with different negative emotions. For example, anxiety encourages active efforts to escape fear-provoking stimuli, whereas depression tends to be characterized by passive behavioral and psychological withdrawal. As a result, the physiological processes associated with these emotional experiences may vary, as may their ultimate health effects. Further research is needed to explore these issues more carefully.

### **Negative Emotions, Morbidity, and Mortality**

Progress in understanding the health correlates of negative emotions can be attributed to some extent to methodologically rigorous studies that have examined the association of these constructs with objective indicators of morbidity (i.e., cases of heart disease, cancer, and other diseases) and mortality (i.e., rates of

death). The next sections highlight some of the central evidence that has related depression, anxiety, and anger to these endpoints. We focus on these negative emotions in particular, because they have been examined with some regularity and thoroughness in relation to objective health outcomes, and because they have been shown to impact the behavioral and physiological pathways outlined above.

### *Depression, Morbidity, and Mortality*

Depression reflects a combination of negative affects such as sadness, loneliness, and guilt, typically accompanied by negative cognition about the self, world, and future, and often associated with behavioral apathy (i.e., a lack of motivation and interest). Hence, depression is characterized by negative valence and low arousal or engagement in the two-dimensional model of emotion. Depressive disorders consist of a constellation of emotional and behavioral symptoms that pervade situations and persist across time. A study by the World Health Organization suggests that depression is second after CVD as a cause of worldwide disease burden, and that it is the leading cause of worldwide disability. Illustrating the significance of the problem, research sponsored by the National Institute of Mental Health (i.e., the Epidemiologic Catchment Area Study) indicated that in any given year, nearly 19 million U.S. adults have a depressive disorder. Depression is particularly common in individuals experiencing chronic or acute medical problems, and therefore, depression has substantial potential to influence initial disease states as well as their progression and course.

Research concerning depression and health has most frequently incorporated cardiovascular endpoints. Alexander Glassman and Peter Shapiro (1998) evaluated findings from a series of studies that examined depression and the risk of mortality from cardiovascular causes in initially healthy community samples, or in clinically ill samples. Across these studies, the risk of cardiovascular mortality was about 1.5 to 2.0 times higher for depressed than for nondepressed individuals. The effect of depression on mortality risk in patients who were already diagnosed with coronary heart disease (CHD; a subtype of CVD that manifests clinically as angina, i.e., chest pain, heart attack, or sudden cardiac death) was even stronger and more consistent. Specifically, when compared with nondepressed patients, depressed patients

recovering from a cardiac event were about four times as likely to die of CHD.

The research concerning depression and cancer is more limited than that regarding CHD, but a recent well-designed study by Brenda Penninx and her colleagues (1998) suggests that depression may predict the risk of cancer incidence (i.e., new cases). Elderly men and women who did not have cancer at the start of the study and who reported chronic depression (i.e., elevated depressive symptoms for 6 years before the follow-up) were nearly twice as likely to contract cancer as those who were not depressed. This effect applied to diverse cancers and was not explained by other risk factors, such as smoking. In contrast, further studies have found no evidence for an association between depression and cancer, as summarized by Kiecolt-Glaser and her colleagues (2002). Depression has been linked to the development of, and outcomes for, an array of additional health problems, including diabetes, osteoporosis, and chronic obstructive pulmonary disease. Depression and related emotional symptoms have also been shown to hasten immunological deterioration and death in some studies of HIV patients, although contradictory evidence has been reported.

Finally, in addition to affecting diverse specific health risks and outcomes, depression may increase the risk of mortality from all causes. For example, a recent, excellent study performed by Richard Schulz and his colleagues (2000) found that depression was an independent predictor (i.e., distinct from other risk factors such as age, socioeconomic status, health behaviors, and initial health status) of mortality in older adults. However, a review of studies concerning depression and mortality conducted by Wulsin, Vaillant, and Wells (1999) describes considerable conflicting evidence. In aggregate, despite the existence of contradictory findings, research indicates that depression confers important health risks, with the strongest available support for a connection between depression and cardiovascular morbidity and mortality.

### *Anxiety, Morbidity, and Mortality*

Anxiety represents a reaction to a perceived or real threat, characterized by worry, fear, or apprehension about the environment and the future, and often accompanied by actions that promote escape from, or avoidance of, the threat. Like depression, anxiety is characterized by negative valence, but it reflects high

arousal or engagement with the environment. Anxiety symptoms and disorders are common in the population. For example, a large study of mental disorders in the United States (i.e., the National Comorbidity Study) estimated lifetime and 12-month prevalence rates for all anxiety disorders at approximately 25% and 17% respectively.

Despite its prevalence in the population, anxiety has been studied less frequently than depression in relation to objective health outcomes. The research that has been conducted has focused nearly exclusively on cardiovascular morbidity and mortality; only a few studies have examined the association between anxiety and other health endpoints, such as cancer or all-cause mortality, and they provide mixed or very limited evidence that anxiety predicts these health outcomes. Thus, the current section focuses on the more compelling research connecting anxiety with CVD.

Laura Kubzansky and her colleagues (1998, 2000) have published two comprehensive reviews of the literature concerning the association between anxiety and CHD risks and outcomes. They note that several earlier studies concerning small samples of psychiatric patients failed to identify an effect of anxiety on these endpoints. However, these studies were characterized by a number of methodological limitations that prohibit definitive conclusions. More recently, a number of well-designed studies of community dwelling populations suggest that higher levels of anxiety engender an elevated risk for cardiovascular morbidity and mortality. For example, a study from the Normative Aging Study found that initially healthy men who reported anxiety symptoms experienced a higher risk of CHD mortality than for nonanxious men, even after diverse risk factors were accounted for. Risk for sudden cardiac death (i.e., unexpected death due to CHD, occurring shortly after the onset of any cardiac symptoms) was 4.5 times as high for anxious men relative to nonanxious men (see Kawachi, Sparrow, Spiro, Vokonas, & Weiss, 1996, for further details). A review by Rozanski, Blumenthal, and Kaplan (1999) describes additional research indicating that anxiety increases the risks for negative outcomes in patients with underlying CHD. Across studies, patients who were high in anxiety had between 2.5 and 4.9 times the likelihood of negative outcomes, including recurrent events and death from cardiovascular causes, when compared with low-anxious persons. Hence, anxiety appears to confer increased risks for CHD morbidity and mortality, although

further research—especially involving women and ethnically diverse samples—is necessary.

### *Anger, Morbidity, and Mortality*

Anger, which varies widely in intensity from irritation and annoyance to fury or rage, often results from perceptions that one has been treated unfairly, and is typically accompanied by tendencies toward aggressive behavior. Anger is characterized by negative valence and moderate-to-high arousal. Hostility is a closely related construct that refers to a collection of negative beliefs (i.e., cognition) about others. Individuals who are higher in trait hostility tend to be cynical and suspicious of others, and they often experience bitterness and resentment. Anger, hostility, and aggression are conceptually distinct but closely related constructs. Substantial research has examined the health implications of trait hostility, as described in an excellent review performed by Todd Miller and his colleagues (1996). Here we focus explicitly on the research concerning angry emotion and health. Like that regarding anxiety, this research has concerned cardiovascular outcomes nearly exclusively.

As reviewed by Kubzansky and Kawachi (2000), prior research suggests that anger relates to initial CHD, and some data also indicate that higher levels of angry emotion may trigger cardiac events in patient populations. For example, a study of community-dwelling men, performed by Kawachi and colleagues (1996), found that men who scored higher on a measure of trait anger had more than 2.5 times the risk of experiencing a cardiac event across 7 years of follow-up when compared with men who achieved lower anger scores. Findings from the Atherosclerosis Risk in Communities Study—a large study of male and female U.S. residents—identified an association between trait anger and incident stroke and CHD, particularly in subgroups that were otherwise at relatively low risk (for additional information, see Williams et al., 2000; Williams, Nieto, Sanford, Couper, & Tyroler, 2002). Other studies have revealed that anger or habitual ways of expressing anger predict atherosclerosis, and retrospective studies indicate that heart attacks may be more likely to occur following intense anger episodes. Thus, at least preliminary research suggests that anger relates to the etiology and course of cardiovascular diseases, and particularly CHD (for further discussion, also see Rozanski et al., 1999; Kubzansky & Kawachi, 2000; Miller et al., 1996).

## CONCLUDING COMMENTS AND FUTURE RESEARCH DIRECTIONS

A substantial body of research suggests that negative emotions, including depression, anxiety, and anger, confer an increased risk for adverse health outcomes, particularly cardiovascular morbidity and mortality. Advances in scientific technologies for studying the physiological underpinnings of emotions and disease processes have helped explicate the pathways through which these health effects occur. Nonetheless, numerous unresolved questions indicate the need for further research.

For example, the pattern of physiological alterations associated with negative emotions suggests that these constructs probably impact health outcomes other than those related to CVD. Some preliminary evidence is consistent with this assertion, but further research is needed to explore alternative endpoints more thoroughly. Additional research that includes refined conceptualizations and measurements of emotions at both normal and clinically significant levels is also needed to determine the threshold at which negative health outcomes occur, and to determine if discrete negative emotions have distinct, additive, and/or synergistic (i.e., multiplicative) effects when present in combination. Substantial overlap among constructs and the tendency for negative emotions to co-occur make explicating the health implications of specific emotions a difficult endeavor. Yet, research that attempts to accomplish this goal will be critical for prevention and intervention efforts.

Future research is also needed to explore the individual and environmental circumstances under which negative emotions are most likely to have a detrimental impact on health. Kiecolt-Glaser et al. (2002) describe a number of factors that may influence “vulnerability” and “resiliency” to the health effects of negative emotions. They note that age is likely to be a moderating factor, so that associations may be strongest during both early and late developmental stages (i.e., childhood and older age). Future research should therefore adopt a developmental perspective to explore if different phases in the lifespan represent critical periods for the effects of emotions on health. Gender may also have an important moderating function. For example, women experience the negative emotions of depression and anxiety far more frequently than men, whereas men report higher levels of anger and hostility. Hence, different emotional processes might be of greater consequence for men’s

versus women’s health. Ethnic/racial differences in levels of negative emotions are less clear. However, due to the potential for increased stress created by exposure to racism and discrimination, and a greater likelihood of residing in low socioeconomic status (SES) environments, minority ethnicity could conceivably increase one’s vulnerability to the health implications of negative emotions. Perhaps these and related psychosocial experiences contribute to the substantial health disparities observed across ethnic groupings.

Additional research suggests the importance of considering SES (i.e., educational attainment, income, occupation status, or community indicators of affluence) in studies of emotion and health. For example, a recent paper by Linda Gallo and Karen Matthews (2003) reviews research suggesting that negative emotional states and disorders are more likely to occur in individuals with lower personal or contextual SES. Furthermore, they describe the importance of a “reserve capacity” of resources (e.g., supportive relationships, self-efficacy) that could protect against the development of negative emotions. The reverse capacity may be less developed in persons with lower SES due to the greater environmental demands they experience, thereby contributing to their vulnerability to negative emotions. Relatedly, although the current entry assumes an individual perspective, environmental contexts are likely to have an important function in shaping emotional states and traits, and should be afforded additional attention. Hence, future research concerning emotions and health must strive to incorporate diverse samples, followed over time and through different developmental stages, to collect information concerning potential vulnerability or resiliency variables (e.g., SES, gender, ethnicity, reserve capacity resources, social networks and experiences, personality), and to examine how environmental contexts may foster or protect against negative emotions and their subsequent health effects.

Despite the many remaining unresolved questions, substantial progress has occurred in understanding the effects of emotions on health since the times of Hippocrates. Future years will undoubtedly continue to see emotions take a more central position in efforts to understand, prevent, and intervene in health and disease processes.

—Linda C. Gallo

*See also* ANGER AND HEART DISEASE; ANXIETY, HEART

DISEASE, AND MORTALITY; DEPRESSION: MORTALITY AND

OTHER ADVERSE OUTCOMES; EMOTIONS: POSITIVE  
EMOTIONS AND HEALTH

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## EMOTIONS: POSITIVE EMOTIONS AND HEALTH

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Folk theories throughout time have promoted the idea that positive emotions are good for your health. This belief dates back at least to biblical times. Proverbs 17:22 advises that "a cheerful heart is a good medicine." Years later, Norman Cousins's (1979) chronicle of his battle with a serious collagen illness using humor and laughter rekindled popular interest in this idea. Until recently, however, such widespread sentiments remained as anecdotal wisdom, without a structured theory to explain how or why positive emotions may be useful to health. Given psychology's penchant to identify, address, and solve problems, research to date has focused primarily on negative emotions. We argue, however, that positive emotions, though relatively mild in nature, are just as noteworthy. In this entry, we discuss Fredrickson's *broaden-and-build theory* (1998, 2001) to demonstrate that positive emotions may provide a useful antidote to the problems associated with negative emotions. Before we introduce the broaden-and-build theory, we briefly review the literature and demonstrate empirical foundations for the benefits of positive emotions in health.

### PHYSICAL AND PSYCHOLOGICAL HEALTH BENEFITS ASSOCIATED WITH POSITIVE EMOTIONS

Researchers have documented numerous salubrious physical and psychological effects associated with positive emotional states. For example, individuals with greater tendencies to use humor to cope (Halley, 1991; Lefcourt, Davidson-Katz, & Kueneman, 1990;



Lefcourt & Thomas, 1998; Stuber, 2002) and who report daily positive mood (Stone et al., 1987; Stone, Neale, Cox, & Napoli, 1994; Stone, Shiffman, & DeVries, 1999) have stronger immune system defenses. In addition, people who are able to regain and maintain positive emotional states are less likely to get sick or to use medical services when faced with a stressful life experience (Catanzaro & Greenwood, 1994; Goldman, Kraemer, & Salovey, 1996). The tendencies to maintain positive emotions, a positive sense of self, and optimistic (even unrealistically optimistic) beliefs of the future act as resources to buffer against the advancement of disease and death (Aspinwall & Taylor, 1997; Taylor, 1983; Taylor & Brown, 1988; Taylor, Kemeny, Reed, Bower & Gruenewald, 2000).

Interventions that promote positive emotions also produce beneficial consequences to health. Pennebaker and his colleagues, for instance, demonstrate that written emotional disclosure can produce significant enhanced health functioning (for a review, see Pennebaker, 1989), especially when positive emotional content is evident in the writings (Pennebaker & Francis, 1996; Pennebaker, Mayne, & Francis, 1997). Corroborating work shows that the advantages associated with positive emotional writing not only provide short-term health benefits, but most important, these benefits can endure for a lifetime. For example, Danner, Snowdon, and Friesen (2001) found that the positive emotional content in the autobiographies of nuns in early adulthood predicted the likelihood of being alive six decades later. Relatedly, Ostir, Markides, Peek, and Goodwin (2001) report that positive emotions in elderly adults protect against physical debility in old age (e.g., less incidents of stroke). In all, these findings exhibit that positive emotions may be valuable tools not only for immediate health concerns but also for establishing long-term beneficial outcomes.

Physical health benefits associated with positive emotions are further established in research on optimism, a dispositional attribute associated with positive emotions. For example, optimists (compared to pessimists) are less likely to suffer from angina and heart attacks (Kubzansky, Sparrow, Vokonas, & Kawachi, 2001) and show better physical recovery immediately after coronary artery bypass surgery and up to 6 months postsurgery (Carver & Scheier, 1998). Taken together, these studies suggest that the relation between physical health and positive dispositional styles (e.g., optimism) may be due in part to the

chronic positive emotional states engendered by the personality style.

In addition to promoting physical health, cultivating positive emotions is associated with psychological health as well (cf. Fredrickson, Maynard, et al., 2000). For instance, coping strategies related to the occurrence and maintenance of positive emotions (e.g., positive reappraisal, problem-focused coping, infusing ordinary events with positive meaning) have been documented as serving to help buffer against stress (Folkman & Moskowitz, 2000; Park & Folkman, 1997; Schaefer & Moos, 1992) and depressed mood (Davis, Nolen-Hoeksema, & Larson, 1998). These strategies help individuals emerge from crises with new coping skills, closer relationships, and a richer appreciation for life, all of which predict increases in psychological well-being.

Empirical support for the prediction that positive emotions are important facilitators of adaptive coping and adjustment to acute and chronic stress is documented in a number of studies (for a review see Folkman & Moskowitz, 2000). For instance, men who were able to find positive meaning when caring for their partners with AIDS were found to cope more effectively with the distress associated with caregiving and bereavement (Folkman, 1997). Similarly, women who found benefits despite hazardous child delivery and prolonged hospitalization postdelivery evidenced greater well-being, which extended to the developmental well-being of their children (Affleck, Tennen, & Rowe, 1991). The occurrence of positive emotions amidst adversity may provide the necessary psychological rest to help buffer against stress, replenish, and restore further coping efforts (Lazarus, Kanner, & Folkman, 1980).

### **The Broaden-and-Build Theory of Positive Emotions**

What functional significance do positive emotions have in promoting favorable consequences of health? A valuable framework from which to understand why and how positive emotions may be useful is Fredrickson's (1998) broaden-and-build theory of positive emotions. Fredrickson (1998, 2001) has argued that, whereas negative emotions heighten people's autonomic activity and narrow their attention to support specific action tendencies (e.g., attack, escape), positive emotions quell autonomic arousal because they broaden people's attention, thinking, and behavioral

repertoires. The broadening effects can be evidenced in the number of thought-action urges related to particular positive emotions: to play and create when experiencing joy, to explore when experiencing interest, to savor and integrate when experiencing contentment, and to combine play, exploration, and savoring when experiencing love (Fredrickson, 1998).

Evidence for cognitive broadening has been illustrated in a program of research conducted by Isen and colleagues. Across several studies, they have shown that induced positive emotions produce patterns of thought that are notably unusual (Isen, Johnson, Mertz, & Robinson, 1985), flexible (Isen & Daubman, 1984), creative (Isen, Daubman, & Nowicki, 1987), integrative (Isen, Rosenzweig, & Young, 1991), open to information (Estrada, Isen, & Young, 1997), and efficient (Isen & Means, 1983; Isen et al., 1991). As well, induced positive emotions increase people's preferences for variety and broaden their arrays of acceptable behavioral options (Kahn & Isen, 1993). These cognitive effects of positive emotions have been linked to increases in brain dopamine levels (Ashby, Isen, & Turken, 1999). In recent work, Fredrickson and Branigan (2002) demonstrate that, relative to neutral states and negative emotions, positive emotions ranging from low activation (contentment/serenity) to high activation (joy/amusement) broaden the scope of people's visual attention as well as their momentary thought-action repertoires (see also Gasper & Clore, 2002).

According to Fredrickson's theory, these broadened mindsets, in turn, have the effect of *building* an individual's physical, intellectual, psychological, and social resources. Positive emotions can momentarily broaden people's modes of thinking, which in turn can improve one's well-being. Over time, and with repeated experiences of positive emotions, a broadened mindset might become habitual. By consequence, then, the often incidental effect of experiencing a positive emotion is an increase in one's personal resources. Most important, the arsenal of personal resources produced by positive emotions can be drawn on in times of need and used to plan for future outcomes, which may be valuable in facilitating healthy behavioral practices (Fredrickson, Maynard, et al., 2000).

### Undoing Effect of Positive Emotions

Evidence for the broadening hypothesis of the broaden-and-build theory (Fredrickson, 1998, 2001)

has clear implications for the strategies that people use to regulate their negative experiences. Negative emotions narrow the momentary thought-action repertoire, producing autonomic nervous system activation, such as increases in heart rate, vasoconstriction, and blood pressure (Fredrickson, Maynard, et al., 2000; Gross, Fredrickson, & Levenson, 1994; Levenson, Ekman, & Friesen, 1990; Ohman, 2000). In contrast, as we have discussed, positive emotions broaden this same repertoire. As such, positive emotions ought to function as efficient antidotes for the lingering effects of negative emotions. In other words, positive emotions might "correct" or "undo" the aftereffects of negative emotions; we call this the undoing hypothesis (Fredrickson & Levenson, 1998; Fredrickson, Mancuso, Branigan, & Tugade, 2000).

We tested the undoing hypothesis by experimentally inducing high-arousal negative emotion (which engenders increases in cardiovascular arousal) and then randomly assigning participants to view emotionally evocative films. We then measured the time elapsed from the start of the randomly assigned film until the cardiovascular reactions induced by the negative emotion returned to baseline levels. In three independent samples, participants in two positive emotion conditions (high activation: joy/amusement, and low activation: contentment/serenity) exhibited faster cardiovascular recovery than those in a neutral control condition, and faster than those in a sadness condition, which exhibited the most protracted recovery (Fredrickson & Levenson, 1998; Fredrickson, Mancuso, et al., 2000).

### Resilience and Positive Emotions

To the extent that positive emotions broaden an individual's array of thoughts and actions, helping to undo the lingering aftereffects of negative emotions, the broaden-and-build theory (Fredrickson, 1998, 2001) proposes that positive emotions should, in turn, help to build personal resources, such as psychological resilience. Theoretical descriptions of psychological resilience indicate that resilient individuals are able to "bounce back" from stressful experiences quickly and efficiently (Carver, 1998; Lazarus, 1993). This theoretical definition suggests that, compared to their less resilient counterparts, resilient individuals would exhibit faster cardiovascular recovery from negative emotional arousal. Together with our work on the undoing hypothesis (Fredrickson & Levenson,

1998; Fredrickson et al., 2000), the broaden-and-build theory suggests that this ability to bounce back to cardiovascular baseline may be fueled by experiences of positive emotion.

In line with previous correlational studies reporting on a link between positive emotionality and psychological resilience (e.g., Block & Kremen, 1996; Klohnen, 1996; Kumpfer, 1999; Masten, Best, & Garmezy, 1990; Werner & Smith, 1992), we predicted that positive emotions contribute to the effects of psychological resilience on effective emotion regulation. We induced negative emotion in participants with a time-pressured speech preparation task. Individuals high in self-reported psychological resilience (Block & Kremen, 1996) reported greater positive emotions in general and in response to the speech preparation task. Moreover, those with higher resilience demonstrated faster cardiovascular recovery from the speech task. Most important, positive emotions at least partially mediated the effect of resilience on cardiovascular recovery. These findings suggest that resilient people may harness positive emotions and use them “intelligently” to achieve their superior coping outcomes (Tugade & Fredrickson, 2002).

### Positive Emotions Build Enduring Resources

To the extent that positive emotions broaden thinking and build enduring psychological resources like resilience, they should also trigger upward spirals toward enhanced emotional well-being. Research on depression had already documented a downward spiral in which depressed mood and the narrowed, pessimistic thinking it brings, influence one another reciprocally, leading to ever worsening functioning and moods, and even clinical levels of depression. In contrast, the broaden-and-build theory predicts a comparable upward spiral in which positive emotions and the broadened thinking they bring also influence one another reciprocally, leading to appreciable increases in functioning and well-being (Fredrickson & Joiner, 2002). Fredrickson and Joiner (2002) examined affective experiences and broad-minded coping (e.g., considering different ways to deal with problems) across two assessment periods, five weeks apart. They found that the effects of positive emotions on well-being increased over time, creating an upward spiral towards enhanced well-being. Positive emotions predicted improved broad-minded coping, which in turn, predicted increases in subsequent experiences of positive

emotions. And again, new experiences of positive emotions enhanced future coping behavior, and so on.

In line with this conceptualization, recently, we have found that positive emotions help to build psychological resources that are essential in coping effectively with traumatic circumstances, such as the September 11, 2001, terrorist attacks on the United States. As part of our ongoing research on positive emotions and resilience, we studied a sample of students prior to the terrorist attacks. This afforded us the opportunity to make a prospective assessment of the benefits of psychological resilience and positive emotions in this crisis. We found that higher psychological resilience was associated with greater experiences of positive emotions, such as gratitude, interest, and love amidst negative emotions, such as anger, sadness, and fear. In addition, higher resilience was linked to postcrisis growth (indexed by increases in optimism, subjective well-being, tranquility). In line with the broaden-and-build theory (Fredrickson, 1998, 2001), postcrisis experiences of positive emotions fully mediated the effect of psychological resilience on psychological growth after the attacks (Fredrickson, Tugade, Waugh, & Larkin, 2002).

### CONCLUSIONS

The broaden-and-build theory (Fredrickson, 1998, 2001) proposes that positive emotions are useful to health in many ways. They facilitate healthy behavior in the present by broadening one's thoughts and attention, which set the stage for creative and innovative pursuits when faced with negative situations. As well, positive emotions build personal and social resources, which serve as protective factors useful in promoting good health in the future. New research indicates that finding ways to cultivate meaningful positive emotions is a critical necessity for optimal physical and psychological functioning. Indeed, positive emotions are good for your health. With increasing research, we continue to empirically substantiate age-old folk theories about positive emotions and health that have persisted through time.

—Michele M. Tugade and Barbara L. Fredrickson

See also EMOTIONS: NEGATIVE EMOTIONS AND HEALTH

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## ENDOGENOUS OPIOIDS, STRESS, AND HEALTH

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The endogenous opioids are a diverse group of neuropeptides with widespread distribution throughout the central and peripheral nervous systems and with far-reaching behavioral effects. For centuries, learned scholars and physicians appreciated the potency of opium in its influence on the body. This led to the speculation that the body must contain sensitive receptor mechanisms that bind and respond to opium and related substances. Thus emerged the enigma of why humans and other animals would evolve receptors for substances of plant origin. Many suspected that the body manufactured its own opium-like substances, and by the mid 1970s the prototypic opioid enkephalin and endorphin peptides had been discovered and their receptors identified. The subsequent characterization of their functional significance has revolutionized our views of psychological stress and its role in the etiology and expression of certain chronic diseases.

The potential medical significance of the endogenous opioids held extraordinary promise. In the 19th century, Sir William Ostler referred to morphine as "God's own medicine" and prescribed it for treatment of systemic disorders such as diabetes, as well as for its analgesic and antidiarrhetic properties. Since that time, opioid neurohormones and neurotransmitters have come to be appreciated as key biochemical mediators of homeostasis with a putative role in the pathophysiology of stress. The body's endogenous opioid neuropeptide systems appear to serve, generally speaking, as extensive and complex inhibitory mechanisms that modulate the fight/flight reaction, thus supporting the maintenance of homeostasis in the face of intense environmental challenges. These newly discovered neurochemicals have become critical foci for understanding certain diseases of adaptation and, hence, for development of novel biobehavioral preventative and therapeutic strategies. In the years subsequent to their discovery, the endogenous opioids

have enjoyed a profoundly significant and continually developing role in the psychophysiology of stress in behavioral medicine.

### CLASSIFICATION AND TERMINOLOGY

The term *opiate* generally refers to substances derived from opium, while *opioid* is a broader classification that includes not only the opiate alkaloids but also the various other substances with morphine-like affinity (binding strength) as well as activity (receptor stimulating action). Thus *endogenous opioids* refers to the general group of morphine-like bioactive peptides naturally synthesized within the body. Recombinant DNA studies suggest, based on separate precursor molecules, three major subgroups of opioid peptides: the endorphins, the enkephalins, and the dynorphins. As with catecholamine and other neurotransmitter systems, there are multiple subtypes of opioid receptors, based on relative affinity for selective agonists (stimulating substances) and antagonists (blockers). Opioid agonists show both affinity and activity at the opioid receptor level. In contrast, opioid antagonists show opioid receptor affinity without activity, and their competition for binding sites displaces or blocks access of agonists. Many opioids display mixed agonist-antagonist properties with affinity and limited activity profiles. Detailed discussion of the biochemical classifications of endogenous opioids and their multiple receptor subtypes is beyond the scope of this entry. It is sufficient to state for the present purpose that the endogenous opioids are not a singular unified system, but rather they constitute a diverse network of neuropeptides functioning as hormones and neurotransmitters, associated with several distinctive receptor systems. The anatomic diversity of opioidergic structures yields, in turn, a similar diversity of function, with widespread influence on behavioral and physiological effector systems.

### ANATOMIC DISTRIBUTION AND FUNCTIONAL SIGNIFICANCE

Endogenous opioid peptides and/or receptors are found localized within both central and peripheral nerve cells as well as within endocrine and other target structures throughout the body. Opioids appear to have both excitatory and inhibitory effects on other systems. Opioids are prominent in pathways mediating the stress response, and there is also a rich representation

of opioids in brain areas mediating reward and reinforcement. Elaborate opioid projections are found in afferent and integrative pain nuclei, as well as in the two major stress effector pathways, the hypothalamic-pituitary-adrenocortical (HPA) axis and the hypothalamic-sympatho-adrenomedullary (SAM) axis. Enkephalins have a widespread distribution throughout the limbic and sympathetic systems, while endorphin-containing cells are especially prominent in the hypothalamus and in the anterior pituitary. Dynorphins are widely represented in both central and peripheral nervous systems. The following briefly overviews the major sites for opioid interaction with neural and endocrine structures mediating systemic reactions to behavioral stressors and other intense stimuli.

### Opioids and Pain Regulatory Systems

The well-known analgesic effects of morphine stimulated an initial search for endogenous opioids and opioid receptors in pathways associated with transmission of pain-relevant impulses. As predicted, a major anatomical distribution of opioid peptides and receptors corresponds roughly to structures related to the perception of, and integrated response to, painful stimuli. For example, enkephalins are found in spinal cord areas associated with transmission of pain impulses and are also widely distributed throughout the limbic system in areas mediating the emotional response to pain. Endorphins are localized in brain areas such as the anterior hypothalamus, innervating the descending pain inhibitory pathways in the parabrachial gray. These anatomical sites of action are consistent with the analgesic properties of many opiates, and point to opioids as mediators of some forms of endogenous analgesia. Both opioid and nonopioid systems work together to form an important and complex endogenous analgesic mechanism, activated by stress and sensitive to classical conditioning and other behavioral manipulations. One endogenous analgesic mechanism has been recently linked to blood pressure baroreflex activity, but the relationship to stress-induced analgesia and the relative role of opioid and nonopioid mechanisms remain to be fully explored.

It has long been recognized that opiates do much more than simply inhibit pain sensation. Notwithstanding their euphorogenic effects, they also appear to render pain-producing stimuli less threatening. This observation reinforces the notion that endogenous

opioid systems play an important role in the higher-level integration of pain perception and in the emotional or affective integration of aversive and/or intense stimuli in general.

### Opioids and Pituitary Function

Consistent with the expansive role of endogenous opioids in the integration of systemic responses to intense stimuli, opioid peptides and receptors are found in hypothalamic and pituitary structures critical to maintenance of homeostasis during stress. For example, beta-endorphins are localized in the anterior and intermediate pituitary and some are costored and coreleased with adrenocorticotrophic hormone (ACTH) under control of corticotropin-releasing factor (CRF) from the paraventricular hypothalamus. Thus, systemic pituitary release of beta-endorphin typically corresponds with activation of the HPA cascade so important in the integrated response to psychological and physical stressors.

Endogenous opioids are also important regulators of hypothalamic cells that control both the anterior and the posterior pituitary. There is a growing appreciation of opioid influences on the stress-induced pituitary release of ACTH and prolactin. There are also important opioid mechanisms that influence release of growth hormone and luteinizing hormone. In the posterior pituitary, endogenous opioids inhibit release of both vasopressin and oxytocin. Thus endogenous opioids can influence regulation of the HPA axis as well as other important neuroendocrine pathways.

### Opioids and the Sympathetic Nervous System

The other primary effector pathway for the stress response is the SAM axis, which activates the peripheral sympathetic nervous system and the adrenal medullae via central autonomic control mechanisms in the hypothalamus and elsewhere. There is ample evidence to suggest that opioids can inhibit sympathetic and adrenomedullary responses at multiple levels of the SAM axis. For example, enkephalins are found in several autonomic ganglia and in the spinal sympathetic intermediolateral cell column. Enkephalins inhibit release of catecholamines from peripheral sympathetic nerve endings and from the adrenal medullae. Central opioids appear to regulate the balance between the sympathetic and parasympathetic nervous systems. Hence, both the SAM and the

HPA axes are subject to inhibition by endogenous opioid mechanisms.

The present body of data suggests that endogenous opioids function as major inhibitory mechanisms, limiting and terminating systemic reactions to stress, and helping to maintain visceral and affective systems within acceptable limits. Thus, major stress effector pathways appear to function under control of a pervasive and diverse endogenous opioid inhibitory system. It appears reasonable to hypothesize that abnormalities of inhibitory opioid function could disrupt important integrative mechanisms and thereby render an organism vulnerable to stress-induced disease processes.

## CLINICAL IMPLICATIONS

Most scientists will agree that the stress response has adaptive significance, especially in anticipatory preparation for the physical exercise of fight or flight. However, it is also widely believed that prolonged, exaggerated, or inappropriate behavioral and/or physiological responses to stress can have pathological consequences. Thus, overly exuberant reactivity to stress is implicated in the developmental etiology of certain diseases of adaptation, including some circulatory, neurological, and psychological disorders. This naturally leads to the notion that diminished function of endogenous opioids could leave the sympathetic nervous system, the HPA axis, and behavioral effector systems disinhibited and thus hyperreactive to psychological stressors. Hence, there may be deterministic relationships between the functional status of endogenous opioid systems and certain manifestations of stress-induced physio- and psychopathology. The following sections briefly detail recent research results on the relationship between endogenous opioids and stress mechanisms in health and disease.

### Opioid Dysfunction in Cardiovascular Disease

There are several lines of evidence linking hypertensive and atherogenic processes to exaggerated sympathetic nervous system responsivity. Hence, both of these disease processes may be influenced by the behavioral and physiological response to stress. For example, the early stages of essential hypertension are characterized by excessive activity of the sympathetic nervous system, with a characteristic pattern of blood pressure dysregulation during stress. Offspring of

hypertensive parents and young people with mildly elevated resting blood pressure show exaggerations of both sympathetic and circulatory stress responses. The role of this exaggerated sympathetic and circulatory reactivity in the etiology of essential hypertension remains to be fully understood, but there are numerous reasons to suspect some causal relationship with opioid alterations. Recent work with the opioid antagonists naloxone and naltrexone suggests that opioids inhibit sympathoadrenomedullary and blood pressure responses to stress in young persons with normal circulatory risk profiles. However, young persons at increased risk for hypertension show reduced opioid inhibitory effects on sympathetic, HPA, and circulatory responses to stress. This apparent dysfunction of inhibitory opioids may underlie exaggerated blood pressure reactivity to stress and its attendant health consequences. Further suggestion of opioid dysfunction in the early stages of hypertension comes from findings of decreased pain sensitivity in hypertensive patients and normotensive persons at risk for later development of hypertension. Opioids are also implicated in silent myocardial ischemia associated with reduced cardiac ischemic pain.

### Chronic Pain

There is an ample literature linking endogenous opioids to acute pain sensitivity, and these systems may also play an important role in chronic pain syndromes. Some theories of chronic pain suggest that endogenous pain regulatory systems, including both opioid and nonopioid systems, may become ineffective upon prolonged painful stimulation. The opioid depletion hypothesis proposes that prolonged exposure to pain stimuli can result in depletion of endogenous opioid analgesic neurochemicals or downregulation of opioid receptors, thus resulting in breakdown of an important psychophysiological mechanism for coping with chronic pain. Apart from their putative role in the basic pathophysiology of chronic pain syndromes, a major focus of current research is to develop better opioid-based analgesics while simultaneously minimizing their addictive potential.

### Posttraumatic Stress Disorder

Endogenous opioids play an important role in coping with traumatic stress and dysfunction of these systems



may be involved in posttraumatic stress disorder (PTSD). Administration of opioid blockers to patients with PTSD results in a constellation of changes that offer clues to the role of opioids in the body's response to prolonged and extreme stress. For example, acute administration of opioid antagonists increases PTSD symptomatology, suggesting that endogenous opioids play a salubrious role in coping with traumatic stress. Opioids appear to mediate a type of classically conditioned stress-induced analgesia observed in traumatized combat veterans. One current formulation is that persons exposed to traumatic stress may utilize their endogenous opioid analgesic and/or affect regulatory mechanisms to cope effectively. Symptoms of PTSD may thus emerge when opioid function is compromised via depletion of endogenous opioid stores, downregulation of opioid receptors, or exposure to opioid antagonists. Additional work is required to more fully evaluate opioid-based pathological mechanisms and therapeutic strategies in PTSD.

### Self-Regulatory Behaviors

Given the importance of intact opioid function in the adaptive behavioral and physiological adjustment to stress, it is likely that opioids play a broader role in self-regulatory behaviors related to substance abuse and appetite dysregulation. The euphorogenic effects of opiates, combined with anatomical and functional representation of endogenous opioids in brain structures associated with reward and reinforcement, illustrate the potential importance of opioids in appetitive mechanisms. By logical extension, alterations in the efficacy of opioid mechanisms may accompany abnormalities of various appetitive self-regulatory behaviors.

Basic research shows release of endogenous opioids during rewarding brain stimulation, suggesting a role of opioid mechanisms in the neural bases of positive reinforcement. If some of the maintaining mechanisms in substance abuse and/or appetite dysregulation are mediated via endogenous opioids, then treatment strategies targeting opioid systems may be potentially efficacious. This possibility finds partial support in studies of the effects of opioid antagonists in treatment for substance abuse disorders. There are a growing number of studies suggesting that treatment with opioid antagonists may facilitate abstinence in alcoholism, smoking, and other dependencies, and

may also facilitate control of appetite in obesity. Therefore, increasing appreciation of the important role of endogenous opioid neuropeptides in mediation of CNS reward systems may point to better management and treatment strategies in substance abuse and other disorders of appetite regulation.

### Opioid Mechanisms in Treatment and Prevention

It appears that dysregulation of endogenous opioid systems, through either opioid excess or deficiency, can contribute to disease etiology. It has been noted that blockade of opioid receptors may provide some benefit in disorders of self-regulatory behavior and possibly PTSD as well. In contrast, deficiency of sympathoinhibitory opioids appears to contribute to circulatory dysregulation during stress and to chronic pain syndromes. Thus endogenous opioid dysfunction has been linked to pathophysiologic processes associated with altered pain sensitivity, altered responsivity of the HPA and SAM axes, and dysregulated appetitive reward systems. Opioids may therefore play an important role in therapeutic and preventative interventions. Interestingly, studies of aerobic fitness, relaxation, and exposure therapies suggest that several forms of behavioral stress management operate via activation of inhibitory opioid mechanisms. Restoration of normal opioid function has been observed in some stress-management interventions with therapeutic and preventative potential. Targeting of disordered opioid inhibitory mechanisms may provide novel strategies for development of new behavioral and pharmacological treatments.

### SUMMARY

The endogenous opioid neuropeptides and receptors form a diverse neural and endocrine system that modulates reactions to pain, stress, and other intense stimuli. These mechanisms have become critical foci for understanding disease-relevant individual differences in the systemic response to psychological stressors and other intense stimuli. A body of data has emerged on the role of endogenous opioids in modulation of the physiological and behavioral response to stress in certain diseases of adaptation and self-regulation. Dysfunction of opioid inhibitory systems may leave an organism vulnerable to the pathophysiological effects of stress and other intense stimuli. These findings have compelled a search for the possible ways

that behavioral and pharmacological manipulation of endogenous opioids can form the bases for novel therapeutic strategies. Better understanding of these important morphine-like neuropeptides and their systemic consequences may provide insight into the developmental etiology and treatment of diseases of adaptation characterized by pathological bodily and affective reactions to stress.

—James A. McCubbin

See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
CARDIOVASCULAR REACTIVITY; IMMUNE RESPONSES TO  
STRESS; METABOLIC SYNDROME AND STRESS; STRESS:  
BIOLOGICAL ASPECTS

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## ERECTILE DYSFUNCTION

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Erectile dysfunction refers to a man's inability to attain, or to maintain, an erection that is sufficient for sexual intercourse. This difficulty has also been referred to as *impotence*, a term that is no longer preferred because it is pejorative. Some men with erectile dysfunction report that they are completely unable to obtain an erection; however, it is more common for

men to report that they are able to obtain a partial erection that is too soft to achieve penetration or that they are unable to maintain their erection long enough to permit intercourse. Men with erectile difficulties often report that they feel less masculine and are embarrassed by the dysfunction; a minority of men report that they feel depressed.

### PREVALENCE

The commonness of erectile dysfunction is suggested by the numerous advertisements that appear on television and in men's magazines and by an active and flourishing commercial interest in medical treatments. Scientific studies provide more precise estimates and suggest that 10% of men report difficulty achieving or maintaining an erection (Simons & Carey, 2001). Several studies demonstrate that prevalence increases with age; for example, Laumann, Paik, and Rosen (1999) reported prevalence rates of 7% among men aged 18 to 29, 9% among men 30 to 39, 11% among men 40 to 49, and 18% among men 50 to 59. Chronic illness such as diabetes and cardiovascular disease increase the prevalence of erectile dysfunction, as does the use of alcohol and other drugs (including some prescription medications) and smoking.

### ETIOLOGY

Erectile dysfunction can be caused by a number of biological, psychological, and social factors. Biological causes can be subdivided into indirect and direct factors. Indirect factors are medical conditions that have no direct pathophysiological influence, but increase fatigue or diminish sexual arousal. For example, a man with chronic obstructive pulmonary disease may feel out of breath during sexual activity and his breathlessness may cause worry and result in erectile failure. Conditions such as diabetes and cardiovascular disease directly inhibit the vascular and neurological mechanisms needed to respond sexually.

Acute alcohol intoxication can impair male sexual arousal temporarily, but can undermine a man's confidence if persistent. Chronic alcohol abuse is more likely to impair sexual functioning on a regular basis due to nerve, testicular, and liver damage. The effects of other drugs are less well studied. It has been suggested that the frequency of erectile dysfunction among heroin users is 28% to 43% and among methadone users is 40% to 50%. Reliable estimates are

not available for other commonly abused substances (e.g., amphetamines, marijuana, cocaine). A number of prescription medications also impair erections.

Numerous psychological factors have been linked with erection problems. Anxiety has been suggested as an etiological factor by several theorists. William Masters and Virginia Johnson (1970) highlighted the importance of performance-related anxiety in particular. David Barlow and his colleagues have found that, compared to nondysfunctional men, men who experience erectile disorder tend to underestimate the amount of erection they are actually achieving, decrease their erection response when demands to get aroused are made, and display negative affect in the presence of erotic stimulation. Barlow (1986) concluded that cognitive interference and negative affect specific to sexual stimuli are central to erectile dysfunction.

Relationship difficulties can impair erections in men. For example, studies have found that dysfunctional men were more likely than sexually functioning males to report more frequent arguments and other deficits in the nonsexual aspects of their relationship (McCabe & Cobain, 1998). Clinical experience suggests that anger toward a partner and lack of trust in a relationship increase risk for erectile dysfunction.

## BEHAVIORAL TREATMENT OF ERECTILE DYSFUNCTION

The behavioral treatment of erectile dysfunction, often referred to as “sex therapy,” begins only after well-trained health care professionals complete a comprehensive assessment that yields information about the causes of the dysfunction (Ackerman & Carey, 1995). For many men, behavioral sex therapy will serve as the primary treatment because the erection problems are caused primarily by psychological or relationship factors; for men in whom biological factors are the primary cause of their erection difficulties, behavioral sex therapy can supplement medical treatments (such as Viagra) to optimize sexual functioning. In either application, behavioral sex therapy has several components (Wincze & Carey, 2001).

## EDUCATION

Sex therapists routinely provide information to correct myths and misunderstandings that adversely affect sexual functioning. For example, the belief that foreplay is for courtship only, or that intercourse is the

only true form of sex, can undermine sexual functioning among middle-aged or elderly men and their partners. Similarly, the belief that the erection must appear before sexual activity begins can limit a man’s sexual opportunities. Education about basic anatomy and physiology, normative sexual behavior, and changes in male and female functioning due to aging is frequently helpful.

## Sensate Focus

Sensate focus exercises, developed by Masters and Johnson (1970), involve discontinuing attempts at intercourse in the early stages of therapy, so that a man and his partner can relearn the basics of being affectionate as well as giving and receiving pleasure. Later, intercourse is reintroduced into their sexual repertoire only after a couple has relearned how to enjoy touching, holding, and kissing.

### *Principles*

Sensate focus exercises are guided by five basic principles. The first recognizes the importance of working with couples, not just identified “patients.” Sex therapists involve both the man and his partner, and recognize that the thoughts, feelings, and behavior of both are important.

Second, sensate focus involves helping a person or a couple to focus on, and develop a heightened awareness of, sexual sensations (rather than sexual performance). Through this, the couple reduces anxiety by striving toward outcomes that are rewarding and achievable (i.e., giving a back rub) rather than striving toward performance goals (e.g., achieving an erection).

Third, sensate focus is structured in that the therapist gives the couple explicit instructions for intimacy; if these instructions are followed, the partners will gradually regain confidence in themselves and in their relationship. However, sensate focus is also flexible in that it can be accommodated to a couples’ unique circumstances.

Fourth, sensate focus involves a gradual approach to change. Theoretically, the procedure of breaking down a complex behavior into smaller steps resembles behavioral “shaping” and facilitates self-efficacy through modest but attainable success experiences; an alternative conceptualization of sensate focus exercises is that they involve an in vivo desensitization procedure that facilitates anxiety reduction.

Finally, sensate focus involves sexual “exercises” that are completed at home to supplement therapy sessions.

### *Procedures*

Sensate focus involves homework and office-based meetings. The homework involves exercises that are typically broken down into sequential phases. The first phase discourages intercourse and encourages nongenital pleasuring or touching while both partners remain dressed. The idea is for partners to begin at a level that is likely to be successful, and involves no performance pressure. The homework assignment may include back rubs or holding hands with variations regarding who initiates, the types of behaviors participated in, and the length and frequency of sessions. After this initial phase, the couple’s experiences and reactions are discussed in the therapy sessions.

The second phase often involves “genital pleasuring,” in which partners extend gentle touching to the genitals and breasts. Partners are encouraged to caress each other in a way that is pleasurable. As before, the couple is discouraged from focusing on performance-related goals (i.e., getting an erection). During therapy sessions, the therapist asks the partners about their experiences and emotional reactions.

Once a couple becomes comfortable with genital touching, the third phase involves the resumption of sexual intercourse; however, this is sometimes broken down into several behaviors, for example, containment without thrusting. The final phase of sensate focus includes intercourse with thrusting. The couple is encouraged to focus on the sensations associated with intercourse and not to be concerned about erections or orgasm. The partners might be encouraged to experiment with different positions.

Through the sensate focus exercises, courtship skills are renewed, and new behaviors are learned as a couple transitions from a performance-based to a pleasure-based approach to sex. Sensate focus may also help to change patients’ perception of their partners. Many men approach sexual intimacy with intercourse and orgasm as the only goals. A partner may begin to see herself as only an object and not as a companion who is loved. The sensate focus procedure can help partners to treat each other with mutual affection rather than as sex objects. Sensate focus also offers an opportunity for individuals to learn to communicate with their partners about sexual pleasures and preferences.

It should be noted that sensate focus is one component of a total treatment approach; it is not a complete therapy in itself. Thus, communication issues, faulty attitudes that interfere with sexual enjoyment, and nonsexual marital conflicts are examples of therapy concerns that may be dealt with concomitantly with sensate focus.

### **Stimulus Control and Scheduling**

Stimulus control refers to efforts to establish a pleasant, relaxing, and erotic environment that is conducive to sexual expression. Time pressures, preoccupation with other responsibilities, and the presence of disruptive stimuli in the immediate environment can impair sexual arousal and functioning. Sex therapy often involves helping couples to schedule occasions for sexual intimacy during times when they are not tired or distracted. Scheduling is designed to overcome the myth that sex should not be planned. Couples are encouraged to schedule time for each other and to plan for it with as much effort as they might for any other special event in their lives.

### **Cognitive Restructuring**

Research suggests that challenging negative or maladaptive attitudes toward sex and reducing interfering thoughts can be helpful components of sex therapy.

Exposing and helping people to change negative attitudes is a complex therapeutic task. Maladaptive attitudes often persist, despite compelling data to the contrary. For example, a man with erection difficulties may have an untrusting attitude toward sexual partners because of an earlier relationship. This experience may generalize to the point that he perceives all partners similarly, despite the fact that not all people are alike. His difficulties may be a reflection of his fear of making a commitment and being manipulated. This attitude would be addressed before working directly on the sexual problem.

Some men (and their partners) may report intrusive images or thoughts that are interfering with sexual enjoyment. The presenting problem may be loss of erection, but the source of the problem is the interfering thoughts. Men sometimes dismiss such interfering thoughts as contributors to sexual difficulties, and focus instead on the perception of their own “inadequacy.” To counter such interfering thoughts, therapists

first help patients to recognize the presence of such thoughts and then to reduce their occurrence by, for example, encouraging patients to focus on erotic thoughts during sexual activity. An alternative strategy involves having patients “compartmentalize” thoughts. Specific times during the day should be set aside to focus on problem-solving; other times are then set aside for erotic thoughts. Putting such categories of thoughts on schedule helps to teach a patient to eliminate negative thinking during sexual encounters.

Negative beliefs and interfering thoughts can present impediments to sexual expression and enjoyment. In some cases, it will be possible to address these cognitive difficulties as a part of the sex therapy itself. In other cases, however, more intensive cognitive restructuring may be needed, usually in the context of individual therapy.

### Communication Training

Communication problems are encountered frequently when dealing with erectile dysfunction. Therapists typically work with couples to help them to improve their listening and communication skills and to provide couples with feedback based on their behavior during therapy sessions. Many therapists also used educational materials and role-play exercises to help couples to communicate more effectively. Therapists also strive to model strong communication skills in their own interactions with patients. This is achieved by listening actively, displaying empathy, asking patients to express themselves clearly, and other techniques.

### Evidence for the Effectiveness of Sex Therapy

Research over the past three decades has established that behavioral treatments for erectile dysfunction can be highly effective when implemented with men whose dysfunction involves psychosocial causes (Heiman & Meston, 1997).

—Michael P. Carey

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## EVIDENCE-BASED BEHAVIORAL MEDICINE

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Evidence-based behavioral medicine (EBBM) is the conscientious review and application of previous literature on behavioral interventions to current practice. Interest in EBBM grew out of the evidence-based medicine movement in the medical sciences that began in Canada about 10 years ago and is now an international effort (Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000). Evidence-based medicine is methodologically applying recent relevant research to clinical questions to inform clinical practice (Rosenberg & Donald, 1995). That is, a clinician reviews recent research evidence or published evidence-based practice guidelines and, in combination with judging the needs for this patient, applies the most efficacious treatment. This process is differentiated from traditional biomedical research in which one relies primarily upon previous training, the most popular practices, and personal experience to address patients' needs. For example, recent evidence from a randomized, placebo-controlled trial suggests that arthroscopic surgery is not superior to sham surgery in treating osteoarthritis of the knee (Moseley et al., 2002). Thus, an EBBM practitioner may decide to

treat osteoarthritis of the knee pharmaceutically, whereas a traditional practitioner may still perform arthroscopy. In addition to the enhancement of patient care, EBBM was initiated to provide researchers and reviewers more practical and systematized ways to communicate with practitioners and policy advocates.

The chain of reasoning for the existence of the evidence-based movement is as follows: (a) patient care can be enhanced if empirical knowledge about behavioral treatments is constantly available, (b) practitioners cannot easily access this knowledge in its current form, (c) practitioner knowledge and skills are subsequently outdated because of the difficulty in obtaining this knowledge, and (d) easily digestible, standardized summaries of the evidence base and regular reviews of this knowledge base by experts, as well as the location and availability of intervention resources, will improve this situation. The social sciences, including clinical psychology and behavioral medicine, began endorsing the importance of systematically reviewing evidence that supports, or refutes, the use of certain treatments only 5 years ago, suggesting that this nascent field is still developing.

EBBM can allow researchers, practitioners, health policy developers, and patients the means by which to evaluate the strength of evidence that exists for a certain behavioral medicine treatment and judge whether the likely benefits of the treatment will outweigh the risks. Ideally, EBBM offers a systematized process by which to consider the evidence available for each treatment so that the best treatment can be chosen for patients with joint medical and psychosocial issues.

#### WHY IS EVIDENCE-BASED BEHAVIORAL MEDICINE IMPORTANT?

Although there are many behavioral medicine treatments and issues for which little evidence yet exists, by promoting EBBM principles researchers and reviewers can be guided to the next level of research that must be conducted to further the evidence base available for the behavioral medicine field. For example, in one area of behavioral medicine, careful review of the evidence available for the psychometric rigor and prognostic usefulness of competing assessment tools may forward standardization of assessment. In another area, the presence of one controlled trial may suggest that further trials, conducted by another investigator or by another laboratory, is now required to test the generalizability of the intervention.

By offering a standardizing approach to the development, test, review, and implementation of behavioral medicine treatments, everyone benefits. Thus, using evidence-based principles allows various audiences to judge the value of certain behavioral medicine interventions and concepts and to consider the ways in which these treatments can best be used or further studied. The ability to inform policy, public health issues, and reimbursement is enhanced when the evidence base is strong and incontrovertible for certain interventions. This type of base only occurs when research is informed by evidence-based thinking.

#### THE DEVELOPMENT OF EVIDENCE-BASED BEHAVIORAL MEDICINE

The U.S. Preventive Services Task Force (USPSTF), a faction of the U.S. Department of Health and Human Services, was developed two decades ago to address similar issues regarding the application of research findings to policy regarding physical health in the form of recommended guidelines for practitioners. They produced the *Guide to Clinical Preventive Services* in 1989, which included a review of evidence on various tests and interventions as well as a five-level score evaluation of the evidence presented. This publication suggested a manner in which the level of evidence could be graded, and when the evidence base was sufficiently developed, practice, insurance, and policy on preventive services could be changed. The USPSTF (currently in its third reincarnation) is funded by the Agency for Healthcare Research and Quality (AHRQ; Woolf & Atkins, 2001). AHRQ, formerly known as the Agency for Health Care Policy and Research, is the body of the Department of Health and Human Services authorized by the U.S. Congress to support improvements in health services, strengthen quality measurement and improvement, and improve health care access, foster appropriate use, and reduce unnecessary expenditures. Two other organizations that systematically review the available literature and disseminate their findings are the Cochrane Collaboration, which focuses on health care interventions, and the Campbell Collaboration, which focuses on social and educational policies and practices.

Both AHRQ and USPSTF have expanded their review of evidence-based practice to include behavioral medicine interventions. For example, AHRQ published clinical practice guidelines titled *Treating Tobacco Use and Dependence* in June 2000 (updated

1996 version) to assist clinicians identify and evaluate the treatment options (both psychological and pharmaceutical) available to their patients. In addition, behavioral counseling interventions for reduced risky drinking, improved dietary practices, and increased physical activity were systematically reviewed and subsequently evaluated in a recent paper published by affiliates of USPSTF (Whitlock, Orleans, Pender, & Allan, 2002). These publications are evidence of government support of the evolution of EBBM from EBM.

Behavioral medicine researchers have developed their own organizations to review interventions. The Clinical Psychology Division of the American Psychological Association created a task force that initiated the use of guidelines in evaluating empirically supported psychotherapy interventions. In addition, a contract was awarded to the Society of Behavioral Medicine by the Office of Behavioral and Social Sciences Research to evaluate the need for evidence-based principles for behavioral medicine. This committee, the EBBM Committee, is mandated to develop guidelines to help clinicians, researchers, and educators use the available research on behavioral interventions to inform clinical work.

## LIMITATIONS OF EVIDENCE-BASED BEHAVIORAL MEDICINE

Several limitations have been reported in using EBBM. For practitioners, there are serious obstacles in the ways in which research findings can be used to inform practice. They want to be aware of and have the best tools to treat their clients, although they do not want to be restricted in their use of nonevidence-based tools. This is thought to happen if certain treatments are privileged over others, based on the available evidence. Alternative or newer treatments may not have received the attention and funding for the necessary research to compile a sufficient body of evidence for comparison with more traditional treatment modalities. Practitioners also may not have training in evidence-based recommended procedures.

The medical community discovered that the reporting of randomized clinical trials (RCTs) was inconsistent and substandard. Incomplete reporting of recruitment, randomization procedures, and multiple exploratory analyses reduced the likelihood of an accurate evaluation and understanding of the clinical methods and findings of a study. Therefore, reporting

guidelines for RCTs, known as the CONSORT Statement, were developed and consequently endorsed by hundreds of medical journals internationally. These guidelines were implemented so that various audiences, from stakeholders to policymakers, could evaluate the likelihood that the tested intervention could improve health.

The CONSORT Statement has been criticized for its focus on the reporting of characteristics that are pertinent to internal validity, or the extent to which the design and the conduct of the trial eliminate the possibility of bias. External validity, or the generalizability of one's study outcomes to the population of interest, is of particular interest to behavioral medicine researchers. Specifically, many of our interventions and research efforts are aimed at diverse populations and/or units of analysis for which generalizability issues are particularly pertinent. The issues that need to be reported to allow the consideration of external validity factors are included in the RE-AIM Framework, developed by Russell Glasgow and his colleagues.

The RE-AIM framework addresses individual and organization level areas of assessment through an evaluation of the reach, efficacy, adoption, implementation, and maintenance of behavioral medicine and other interventions. Reach (individual level) is the generalizability of the results to the correct population or unit of analysis and includes consideration of the rates of exclusion from an intervention study, participation rate among eligible persons, as well as the representativeness of the participants. Efficacy (individual level) is the effect of the intended intervention on the prespecified outcome (an internal validity issue) and also the impact of the intervention on potential negative effects or adverse events. Adoption (organization level) is the uptake or the agreement to be in the study by the settings and the providers (intervention agents) who were invited to enter the study. Thus, a study may have very good internal validity and seem to have very promising findings, but if very few participants were eligible to enter into the trial and almost no settings or providers were willing to be in the trial, the intervention is unlikely to be adopted by other settings or have broad public health impact. Implementation (organization level) represents a consideration of the costs (either in dollar value or in time) to provide an intervention as well as the types of providers required to successfully deliver the differing components of an intervention. Hence, if an intervention requires substantial physician time to diagnose and refer, and then

additional nursing time to screen and schedule appointments, and finally psychotherapist time to deliver the group therapy, all of these human resources should be considered in the evaluation of the feasibility of that particular intervention. Finally, maintenance (both individual and organization levels) is a careful deliberation of the organizational and provider commitment to continue offering the intervention after the study is completed, as well as the participant's maintenance of the new behaviors/intervention. These generalizability issues, while infrequently discussed in medical evidence-based chapters, are considered extremely relevant to the EBBM movement.

Thus, the EBBM Committee has augmented the existing guidelines compiled by CONSORT with the RE-AIM criteria by Glasgow and his colleagues. The guidelines have also been expanded to include behavioral-medicine specific concerns, including treatment fidelity, provider and patient adherence and allegiance, and other issues specific to behavioral medicine prevention and intervention efforts (Davidson et al., in press).

## POLICY IMPLICATIONS OF EVIDENCE-BASED BEHAVIORAL MEDICINE

There is both concern and anticipation about the influence of EBBM on policy. It begins with the question of what is evidence and who has the power to define it. It continues through who reimburses and reinforces EBBM practices and it ends with what kind of overall benefit results for clients, and populations, in genuine health improvement. In some areas of medicine, the introduction of the evidence-based movement has resulted in the cessation of reimbursement of some medical practices, because the evidence suggested that these routines were harmful or only minimally beneficial, but there has been continuing lack of reimbursement for well-supported treatments, such as smoking cessation. Thus, lobbying efforts, politics, and sophisticated use of such models as the push-pull-delivery capacity model (Orleans, Gruman, & Anderson, 1999) are all needed to have policy appropriately informed by evidence bases.

## FUTURE DIRECTIONS

EBBM is a challenge but it is also an opportunity. It is an opportunity to gain credibility for behavioral medicine interventions and provide a forum for this to occur. In examining the movement as it has progressed in medicine, proposed treatments have been

successfully tested, improved, adopted, and finally certified as standard of care. In behavioral medicine, there are competing alternative treatments for similar disorders with little systematic evaluation of which is best. Without a process in place by which behavioral medicine interventions can progress to become a standard of care, the field may continue to be undervalued. An effort to influence policy cannot be successfully mounted without systematic evidence. Quality care for our patients, adequate reimbursement for clinicians, and appropriate and useful interventions to be taught to students also result from an evidence-based movement.

—Karina W. Davidson and Kimberlee J. Trudeau

See also RESEARCH TO PRACTICE IN HEALTH AND BEHAVIOR

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## EXERCISE. See PHYSICAL ACTIVITY INTERVENTIONS

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## EXPLANATORY STYLE AND PHYSICAL HEALTH

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For the Western world, a historical view of how the healing professions have approached the treatment and prevention of illness reveals three major eras. Throughout most of history, up until the time that germ theory emerged in the 1800s, the focus was solely on disease treatment. People went about their lives until they fell ill; then physicians entered the picture and attempted to combat the illness.

In the second era, starting with germ theory, the focus expanded to disease prevention. Public health workers tried to prevent germs from entering the body. Swamps that hosted malaria-carrying mosquitoes were drained; surgeons began to wash their hands before and after they operated; food was inspected and dated for freshness. What these first two eras had in common is that the individual who was supposed to benefit from their approaches was passive. He or she did nothing except to go along with the efforts of the physician or the public health expert.

In the third and most recent era, taking form in just the past few decades, the focus shifted to health promotion. The person was called upon to make an active effort to behave in health-promoting ways. The related fields of health psychology and behavioral medicine exemplify this third era. In both fields, psychological factors are identified that contribute to physical well-being or its absence. Among these factors

are thoughts and beliefs, and this contribution surveys what is known about the role of a particular cognitive personality characteristic—explanatory style (also known as attributional style)—in health and illness.

## EXPLANATORY STYLE AND ITS MEASUREMENT

Explanatory style refers to how an individual habitually explains the causes of bad events. This cognitive personality variable is sometimes described as pessimistic (when bad events are explained with causes that are long-lasting [stable], pervasive [global], and internal to the self—e.g., “It is going to last forever; it will undercut everything; and it is my fault”) versus optimistic (when bad events are explained with causes that are transient [unstable], circumscribed [specific], and external to the self—e.g., “It was a fluke”). Explanatory style is thought to be a distant influence on the specific expectation that one’s behaviors are related (or not) to important outcomes. A pessimistic explanatory style therefore encourages individuals to believe that they are helpless, that nothing they do matters, whereas an optimistic explanatory style encourages individuals to believe that their behaviors do affect outcomes. Accordingly, pessimistic people are prone to learned helplessness, and optimistic people are not.

Explanatory style began as its own line of research when measures of this individual difference were developed. The most often used measure is a self-report questionnaire called the Attributional Style Questionnaire (ASQ), which presents respondents with hypothetical bad events involving themselves and asks them to provide “the one major cause” of each event if it were to happen to them. They then rate these provided causes along dimensions of internality, stability, and globality. Ratings are combined by averaging.

A second way of measuring explanatory style is with a content analysis procedure—the CAVE (an acronym for Content Analysis of Verbatim Explanations)—which allows written or spoken material to be scored for naturally occurring causal explanations. Researchers identify explanations for bad events, “extract” them, and present them to judges who rate them along the scales of the ASQ. The CAVE technique has been used to analyze psychotherapy transcripts, diaries, interviews, open-ended questionnaires, political speeches, sports stories, religious texts, and song lyrics. The greatest methodological virtue of this approach to studying explanatory style is that it allows

longitudinal research to be conducted retrospectively. If suitable verbal material can be located from early in the lives of individuals whose long-term fate is known, then the CAVE technique allows studies to be done very quickly, which nonetheless span decades. For obvious reasons, studies of explanatory style and physical well-being have frequently relied on the CAVE.

## EXPLANATORY STYLE AND PHYSICAL WELL-BEING

Several dozen studies exist that have attempted to establish a correlation between explanatory style (measured with the ASQ or the CAVE) and physical well-being. Taken together, these studies converge to show that optimistic explanatory style predicts good health operationalized in a number of ways, from self-report to physician ratings of general well-being to doctor visits to survival time following a heart attack to immunological efficiency to longevity.

How strong is the association between optimism and good health? Most of the relevant studies report correlation coefficients in the 0.20 to 0.30 range, which are moderate in size and typical of correlations in psychological research. Research participants included males and females, some initially healthy and others initially quite ill. Adults across the lifespan were included. Many of these studies were longitudinal, spanning mere weeks to almost five decades. And at least some of these longitudinal studies statistically controlled for initial levels of health and potential confounds involving tendencies to complain.

Explanatory style apparently impacts health at a number of junctures. It can make the initial onset of illness less likely; it can minimize the severity of illness; it can speed recovery; it can make relapse less likely. Most of the relevant studies, by virtue of rather stark correlational designs, do not allow conclusions about when health is impacted. Nor do they establish causality. Future investigations of a more fine-grained nature are of course indicated.

## EXPLAINING THE LINK BETWEEN EXPLANATORY STYLE AND HEALTH

The most basic question that arises from research into explanatory style and health involves the mechanism linking the two. The link appears to be overetermined, and there are a number of plausible routes.

For example, there may be an immunological pathway. Some research suggests that optimistic explanatory style is positively correlated with the vigor with which the immune system responds to an antigen challenge. And several other studies have looked at how explanatory style is linked to the progression of AIDS. Results are mixed, but there are hints that optimism predicts survival time and that this effect is mediated in part by immunological factors.

There may also be an emotional pathway between explanatory style and health. An extensive research literature shows optimistic explanatory style to be incompatible with depression, and other studies have linked depression to poor health and early death. At least part of this latter path may be immunological.

There are probably several cognitive pathways between explanatory style and health as well. One's habitual style of explaining bad events is not an isolated belief, like an obscure phone number, but rather part of a complex knowledge system that can impact physical well-being in numerous ways. For example, individuals with optimistic explanatory style see the world as less filled with hassles than do their pessimistic counterparts; this tendency in turn is linked to better health. For another example, individuals with optimistic explanatory style believe that good health can be "controlled" (i.e., promoted and maintained).

Another explanation of why optimistic thinking is related to physical well-being points to a social pathway. People with a pessimistic explanatory style are often socially isolated, and social isolation is a consistent predictor of poor health.

In general terms, the individual's social context can set the stage for the link between explanatory style and physical health. In 1987, Leonard Sagan argued that the dramatic increase in life expectancy in the Western world over the centuries was due not to breakthroughs in medical or public health practices but instead to cultural diffusion of the originally radical notion that an individual is a discrete self able to have an effect on the world. Once the idea of individual agency was invented, legitimized, and disseminated, the findings so far discussed became possible.

The most typical and most robust mechanism is probably a mundane behavioral pathway. So optimistic explanatory style is associated with a variety of "healthy" practices: exercising, drinking in moderation, avoiding fatty foods, and the like. People with

optimistic explanatory style were more likely than their pessimistic counterparts to respond to colds with appropriate actions: resting and consuming more of Mom's chicken noodle soup.

In 1998, Christopher Peterson and colleagues reported a study of explanatory style and physical well-being that looked at more than 1,000 individuals over almost 50 years. Pessimistic individuals had an increased likelihood of an early death, and the large sample size made it possible to investigate associations between explanatory style and death due to different causes. In contrast to the intuitive hypotheses that death by cancer (long described as a "disease of despair") and perhaps death by cardiovascular disease would be especially linked to a pessimistic way of thinking, this study instead found that pessimistic individuals were most likely to die accidental and/or violent deaths. The effect was particularly pronounced for men.

Deaths like these are not random. "Being in the wrong place at the wrong time" may be the result of an incautious and fatalistic lifestyle entwined not only with pessimism but also with the male gender role. This study did not reveal what deceased research participants were doing when they died accidentally or violently, but Peterson and colleagues speculated that behavior was somehow implicated, if only by affecting the settings that individuals habitually entered or not.

A series of follow-up studies by Peterson's research group supported this hypothesis. First, they discovered that a pessimistic explanatory style predicted the likelihood of traumatic injuries requiring medical attention. Again, this effect was more pronounced for males than females, especially in the young adult years. Second, they showed that a pessimistic explanatory style was associated with a preference for potentially dangerous activities—e.g., driving recklessly or drinking excessively. Again, this association was more likely for males than for females. Third, they showed that this pessimism-driven preference for dangerous activities translated itself into risky behavior and actual trauma when individuals were in bad moods.

## CONCLUSIONS: IMPLICATIONS FOR PREVENTION AND TREATMENT

Can a lifetime of good health be encouraged by the early cultivation of optimism? Researchers at the University of Pennsylvania have described an intervention program that involves teaching grade-school

children to be more optimistic. Results suggest that optimism training makes subsequent episodes of depression less likely and may pay the added dividend of encouraging good health.

One can similarly ask if optimistic ways of thinking acquired once an individual falls ill will boost good health. Again, studies of optimism and depression suggest that this question is worth pursuing. Cognitive therapy that targets negative ways of thinking alleviates depression and prevents its recurrence. By implication, cognitive therapy for the seriously ill might have health benefits.

—Christopher Peterson

See also OPTIMISM, PESSIMISM, AND HEALTH

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## EXPRESSIVE WRITING AND HEALTH

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For centuries people have written poems, novels, and journal entries as a way to help them cope with disturbing personal events. Psychologists, on the other hand, have traditionally followed Freud's lead and favored a "talking cure." The idea that a "writing cure" may be at least as powerful was left unexplored until the mid-1980s, when researchers discovered that asking people to write about traumatic experiences improved their mental and physical health.

### A TYPICAL EXPRESSIVE WRITING EXERCISE

Most written disclosure studies have used the same basic procedure. Researchers arrange for people to come into the research lab on each of about 4 or 5 days. On the first day, the experimenter divides people randomly into two groups. Everyone is asked to write for 20 minutes each day, but the topic depends on which group they are in. Those in the expressive writing group are told something like this:

I would like for you to write about your very deepest thoughts and feelings about an extremely important emotional issue that has affected you and your life. In your writing, I'd like you to really let go and explore your very deepest emotions and thoughts. You might tie your topic to your relationships with others, including parents, lovers, friends, or relatives; to your past, your present, or your future; or to who you have been, who you would like to be, or who you are now. You may write about the same general issues or experiences or on different topics each day. All of your writing will be completely confidential. Don't worry about spelling, sentence structure, or grammar. The only rule is that once you begin writing, continue to do so until your time is up.

The remaining people in the study serve as a control group. Control participants write about nonemotional topics, such as how they manage their time. Neither group receives feedback about their writing. All participants are followed over a period of weeks or months to see if a difference in physical or mental health appears between the groups.

### THE EFFECTS OF EXPRESSIVE WRITING

Participants typically reveal deeply personal information, from childhood abuse to bereavement to the details of romantic relationships. In the short term, writing often upsets those in the expressive group. Nevertheless, in the long run, participants in the expressive writing group report being happier and healthier than controls. Many feel writing helped them to come to terms with disturbing events. Furthermore, their scores on formal measures of emotional well-being surpass those of people who write about a superficial topic.

Expressive writing can also lead to improved life chances: after writing, students get better grades and recently laid-off professionals find work more quickly. This could be because people who have had some kind of dramatic emotional experience often become preoccupied with it. They feel compelled to dwell on the issue (or ruminate), and experience intrusive thoughts about the event. Rumination and intrusive thoughts can consume considerable mental time and energy, taking up working memory resources that could otherwise be used for study or other tasks relevant to personal success. The writing task forces people to sit down and articulate the experience, label the emotions, and try to find some kind of coherence or meaning. This exercise alone may be enough to bring about cognitive change that reduces rumination and intrusive thoughts. Indeed, Kitty Klein reported that people's working memory increased after emotional writing, allowing them to process a greater range of information.

Most striking is that multiple experiments have found that expressive writing can improve people's physical health. In the weeks after writing, participants tend to go to the doctor less, take fewer sick days off work, and suffer fewer symptoms of chronic illnesses, such as rheumatoid arthritis. Yet the health benefits of writing are not simply due to inspiring people to take better care of themselves. Diet, exercise levels, and other health behaviors remain largely unchanged. Instead, writing reduces overall stress levels due, in part, to people no longer ruminating about the emotional upheavals. Heart rates and skin conductance levels (i.e., sweating) fall, indicating greater relaxation. Immune system responses strengthen. For example, expressive writing participants show increased antibody levels as part of enhanced immune responses to hepatitis B vaccinations.

Expressive writing also helps participants who test positive for the Epstein-Barr virus to keep the dormant infection under control.

#### WHAT MAKES FOR AN EFFECTIVE WRITING TASK?

The writing task can be structured and worded in many different ways, but certain features may be important. People should be told to aim for a coherent narrative that not only describes feelings but also discusses what (or who) those feelings are about. Simply writing down feelings without putting them into context does not work. Merely venting emotion is not enough. Research by Dan McAdams suggests that people have a fundamental need to create stories about themselves, and these stories are at the core of a person's identity. It makes sense that an expressive writing exercise has such enormous psychological impact, because it involves organizing and articulating people's life stories.

Writing certainly works if people are told to write about upsetting topics. The first writing studies, conducted by James W. Pennebaker and his colleagues, asked people to write about the most traumatic event of their entire lives. This fits with received wisdom of psychotherapists that effective psychotherapeutic work is and must be inherently painful. However, later research findings challenged "no pain, no gain" assumptions. Laura King reported improved health after writing, even for people who did not venture into deeply traumatic waters. For example, health improved for people who wrote about the positive aspects of negative experiences, such as having cancer, or about experiences that are likely to be a mixture of positive and negative, such as coming to college. Writing exercises do more than offer a safe space for confronting traumatic memories or thoughts. Writing may help someone to see a past experience in a new light, recognize the positive aspects of their current situation, or be more optimistic about the future. These findings mean that writing is a therapeutic option even for people who find it difficult to bear the short-term distress of a trauma-writing exercise.

#### WHO BENEFITS FROM WRITING?

People from all walks of life often benefit from emotional writing, compared to a control writing

exercise. Studies have found health gains for young and elderly people, for highly educated people and the barely literate, and for individuals with diagnoses of psychological disorders as well as individuals whose psychological health is generally good. Benefits have even been found for sex offenders in prison. Data from Europe, North America, Central America, and Asia all show positive results. Nevertheless, some people benefit more than others. For example, some studies have found that males benefit more than females, and hostile people benefit more than less hostile people. One possibility is that men and people with hostile personalities are less likely to have already expressed their emotions prior to writing.

Reading what people write can help researchers determine which people are most likely to show health improvements, and why. Pennebaker and his colleagues developed a computer program that counts how often different types of words appear in a passage of text. They found that participants whose essays contained a high number of positive emotion words (e.g., *pride*, *joy*) and a moderate number of negative emotion words (e.g., *sad*) showed greater benefits than people who did not use emotional words as often. An even better predictor of health improvements was a pattern of increasing use of cognitive words (e.g., *think*, *realize*, *because*) from the first to the last day of writing. Cognitive words often appear in stories or narratives. Those people who are able to put together a meaningful account of their traumas, then, may be the very people most likely to show improvements in health.

In a further study, Sherlock Campbell and Pennebaker used a technique that measured the similarity between different essays written over the course of 3 days. People who used different pronouns (e.g., *I* vs. *she* vs. *they*) on different days of the exercise showed greater health benefits. It may be that writing works if it provides an opportunity for a person to explore a particular experience from a variety of viewpoints, organizing the memory, and obtaining some distance from it.

#### HOW DOES WRITING COMPARE WITH TALKING?

Writing provides some of the same health benefits as talking to a therapist. This might come as a surprise, because people usually assume that the therapist's feedback is crucial. Indeed, rival psychotherapy

schools (e.g., feminist vs. Freudian) have had heated debates over the details of feedback techniques. Yet, writing involves no immediate feedback. Even if someone else will eventually read what the patient has written, the actual process of expressing emotional experiences through writing is completely one-sided. Indeed, the exercise works even if the patient plans to destroy the writing. The writer controls the topic, the order in which emotions and events are described, and the tone and language used to describe them. A related advantage is that the writing has no direct impact on other people, and so does not put relationships at risk in the way that expressing negative emotions to a close other can do.

Most critical is that emotions and emotional events are expressed in the form of words. Talking into a tape recorder works, but expressing emotion nonverbally does not. After expressive dance exercises, for example, people claim to feel better, but their objective health indicators are no different from those of a control group. The writing research, then, has helped to isolate one critical feature of psychotherapy: verbal emotional expression. This also happens to be a feature shared by nearly all psychotherapies. So, almost any type of psychotherapy is likely to be beneficial to some degree, as long as it provides the opportunity to express emotional events using words.

## HOW DOES EXPRESSIVE WRITING WORK?

The original explanation Pennebaker offered was that chronically avoiding disclosure of some highly emotional experience constituted a long-term stressor. Like other long-term stressors, this placed an extra burden on the body's immune system and other coping mechanisms. Writing was presumed to address this inhibition by allowing people to come to terms with unexpressed experiences. Once the events were expressed in writing, people would no longer be inhibiting thoughts and feelings about those events. This explanation fit with evidence that people concealing a stigma such as being gay were less healthy than those who were out of the closet. However, further research found that writing about

traumas that have already been disclosed to another person can be just as beneficial as writing about a true secret. It is not simply that being the sole witness to powerful experiences is sufficient to impede health.

An alternative explanation is that writing helps people put their psychological affairs into order, and that this order is in itself beneficial because it reduces rumination. As in the case of the inhibition explanation, the removal of this chronic stressor could improve health. This theory also explains why the exercise works even if people destroy their essays at the end of writing, because it could be the act of writing a story, not the act of communicating, that is beneficial.

Even if we do not know exactly why it works, the overall message from nearly 20 years of research on the relationship between writing and health is that most people would benefit from being given the time, privacy, and encouragement to write about their emotional experiences.

—Carla J. Groom and James W. Pennebaker

See also EMOTIONS: NEGATIVE EMOTIONS AND HEALTH;  
REPRESSIVE COPING AND HEALTH; STRESS, APPRAISAL,  
AND COPING; STRESS-BUFFERING HYPOTHESIS

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## FIBROMYALGIA SYNDROME: BIOBEHAVIORAL ASPECTS

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### PREVALENCE AND DIAGNOSIS OF FIBROMYALGIA SYNDROME

Fibromyalgia syndrome (FMS) is a growing diagnosis in America with an estimated 2% to 6% of adults (4-12 million) but more women (estimated at 3.4-10.5%) than men (0.5%) having FMS. Prevalence increases with age and peaks between 50 and 80 years old. Several features of FMS overlap with other chronic painful and fatiguing conditions such as chronic fatigue syndrome (CFS), irritable bowel syndrome (IBS), and temporomandibular disorders (TMD), among others. These conditions share the dubious distinction of having no clear pathological markers, which precludes definitive tests, and so are diagnosed by symptoms and exclusion of other possible diagnoses. Many people display symptoms that meet diagnostic criteria for more than one of these conditions (Bennett, 1998); overlapping symptoms particularly include unexplained and enduring fatigue, diffuse or widespread muscle and joint pain, sleep disturbances, and activity intolerance. Many individuals with FMS also meet criteria for CFS, and many studies include subjects with either or the dual diagnoses. In this entry, the signs and symptoms for diagnosing FMS as well as the dominant underlying biobehavioral associated factors and potential functional alterations are discussed.

FMS is characterized by widespread pain (above and below the waist, in the right and left sides of the skeleton) for at least 3 months, pain when pressure is

placed on 18 discrete body locations (called tender points), and unexplained extraordinary fatigue (Wolfe et al., 1990). People also are likely to report other symptoms such as stiffness; numbness or tingling; sleep disturbances; headaches; stomach or bladder symptoms; and inability to concentrate, remember, or think properly, a condition that patients refer to as “fibro fog.” The consequences in the most severe cases include profound inability to perform activities of daily living and work. Susceptibility to FMS may run in families, and studies of genetic factors are emerging, particularly in relation to alterations in the brain chemical serotonin, which is active in regulating mood states, pain experiences, and behaviors such as sleep.

### THE LINK OF FMS TO LIFE STRAIN AND EMOTIONAL DISTRESS

Clinically, both onset and continuation of FMS symptoms are related to stressful, that is, physically and/or emotionally challenging, circumstances. Individuals who report high life strain as measured by exposure to negative life events, major ones and daily hassles; sexual, physical, or emotional abuse; and engaging in overactive mental or physical lifestyles are predisposed to FMS (Van Houdenhove et al., 2002). Individuals with FMS report more negative life events and they rate the events as more disturbing than people without FMS. The majority of people can pinpoint an onset event or a trigger such as severe infectious-like illness, physical injury (surgery, accidental trauma), or a circumstance evoking intense emotional upset.

According to the results of in-depth interviews, coping patterns vary across individuals. Some people

perceived managing their everyday life by mobilizing their physical and psychological strength to overcome the pain and fatigue, others by adjusting their activities according to what they assume as their limitations; some in despair no longer wanted to cope with their pain and life situation; and some had given up many activities of everyday life and felt that their symptoms dominated their life.

Patient delay in seeking treatment and clinician underrecognition of FMS and CFS means that people often receive a diagnosis and help with treatment only after years of suffering. People who have untreated psychiatric and physical illness, experience unrelieved life strain, and succumb to being very inactive with prolonged work absence are most at risk to have very protracted recovery times.

Some but not all people with FMS have a tendency to have mental illness in higher numbers than people with chronically painful diseases such as rheumatoid arthritis or multiple sclerosis. Depressed mood and anxiety are evident in large numbers of patients meeting criteria for FMS and CFS, and roughly 25%-30% of patients with FMS who present for treatment have major depression. Many have a lifetime history of major depression and panic disorder (Demitrack & Crofford, 1998) as well as high rates of familial major mood disorder. While psychiatric illness is often considered as an overlay on FMS (i.e., comorbid), the somatic and emotional manifestations of FMS could emanate from shared or common brain chemical (neuromodulator) disturbances. At issue is whether negative mood changes follow or precede the pain and fatigue symptoms of FMS/CFS or whether or not they are part of the overall syndrome.

#### LINKING LIFE STRAIN, DISTRESS, AND FMS PHYSICAL SYMPTOMS

The obvious connection of FMS to environmental life strain and personal emotional/mental distress has given rise to two main lines of investigations to help explain FMS symptoms, particularly pain and fatigue. One line involves disturbances in the stress nervous and hormone systems, that is, the autonomic nervous system and the interactive features of the hypothalamus, pituitary, and adrenal glands (called the HPA axis). The other investigative line involves brain and spinal cord chemical neuromodulator disturbances that likely underlie unusually heightened pain sensitivity.

#### Changes in the Stress

##### Nervous and Hormone Systems With FMS

Several changes in stress-related hormone patterns and functions are seen in people with FMS (Demitrack & Crofford, 1998). Stress hormones (e.g., epinephrine, norepinephrine, cortisol) normally fluctuate as individuals adapt to any unusual and challenging environmental circumstances. A healthy, normal pattern includes elevation of these hormones and return to resting levels within short periods of time as one adjusts to the special situations. A large portion of this activation involves the sympathetic nervous system (SNS) with release of epinephrine and norepinephrine into the bloodstream and into tissues. This serves to create a number of alerting bodily changes that prime for defending against danger or harm, the sum total of which was historically called the fight-or-flight response. In some individuals, this protective activation pattern is prolonged and enduring, perhaps due to inherent behavioral style or due to repeated exposures to activating circumstances. Over time, excessive activation can lead to a reduced ability to adjust in the usual way to challenging circumstances with low hormone levels and weakened responses of tissue cells to the hormones. Several observations reveal altered SNS function in people with FMS/CFS, including poor blood flow responses when cold is applied to the hands, inadequate SNS activation in response to stress conditions such as exercise or noise, and failure to rapidly adjust blood pressure upon changing positions or posture, for example, from lying down to standing.

During threat of or actual emotional or physical challenge, besides activation of the SNS (seen in higher levels of epinephrine and norepinephrine), activation of the HPA axis involves the release of corticotropin-releasing hormone (CRH) from the brain hypothalamus, which affects the pituitary gland and its release of adrenocorticotropin hormone (cortisol release from the adrenal glands into the bloodstream). People with FMS can display low 24-hour blood levels of free cortisol, and a vigorous adrenocorticotrophic hormone (ACTH) but blunted cortisol response to injected CRH, indicating reduced responsiveness of the adrenal glands. In addition, patients with FMS can show low blood levels of growth hormone (GH), thyroid stimulating hormone, thyroid hormones (free T<sub>3</sub> and T<sub>4</sub>), and insulin-like growth factor-1. The vast majority of people with FMS



report sleep disturbances, which might be linked to at least some of the hormone changes. Their sleep has been observed as lighter and more fragmented in the early part of the night (e.g., the time when GH peaks), and people predominantly report waking up tired or unrefreshed from their sleep. Low levels of GH, among other hormones, are correlated to and perhaps instigate or are a consequence of sleep disturbances.

Both CRH and cortisol, as well as other hormones, have wide-ranging effects on emotions, thinking, and behaviors that resemble many of the clinical features of FMS. For example, in animals, CRH produces physiological and behavioral arousal behaviors that are in synchrony with the clinical picture seen in FMS—that is, reduced energy, tiredness, reactive mood, and weight gain. It has been argued that the low cortisol response and CRH pattern might explain overlap between FMS (and perhaps related conditions) and psychiatric illness. There is evidence that “melancholic” type major depression is manifested in CRH and cortisol elevations. However, “anergic” type depressive illness is manifested in reduced activity of the HPA axis and is associated with profound fatigue, bodily symptoms, and mood reactivity, similar to those in FMS. This latter pattern also is evident in the depressive phase of bipolar illness, seasonal affective disorder, and with primary low-thyroid conditions (Demitrack & Crofford, 1998).

Questions remain as to the role of inherent tendencies to autonomic nervous system and HPA disturbances versus acquired tendencies due to prolonged chronic stress exposure, reduced physical activity, and sleep/wake disruptions in the development or continuation of FMS/CFS. Furthermore, while disrupted SNS and low HPA responsiveness can potentially help explain fatigue and cognitive or emotional upset in FMS, it does not go far in explaining the exquisite pain sensitivity that people with FMS report.

In FMS, the point at which sensory input (e.g., touch pressure) becomes painful is lower than normal and pain tolerance is low. When pressure was applied to designated tender points, people with FMS displayed a steady linear rise in pain intensity ratings from the beginning as pressure was increased. In contrast, control subjects reported no pain over the first half of the pressure intensity application, followed by a rapid rise in reported pain after that point (Bendtsen, Norregaard, Jensen, & Olesen, 1997).

### Possible Explanations for Heightened Pain Sensitivity

Scientists are pursuing evidence for brain and nerve alterations that might explain heightened pain in the face of no obvious tissue injury as is evident in FMS. For example, blood flow to key areas of the brain involved in pain sensation is augmented in people with FMS compared to those without FMS. Evidence that chemicals active in pain transmission and modulation, both excitatory ones in excess or imbalanced against inhibitory ones, is being pursued. As reviewed by D. J. Clauw (1995), major excitatory chemicals that potentially heighten pain sensitivity include amino acids (building blocks of proteins) acting on cell membrane receptors (N-methyl-D-aspartate type). Another is Substance P, a chemical within nerve endings that facilitates pain nerve cell transmission in tissues, including spinal cord neurons (i.e., dorsal horn section known to be active in pain inputs), thereby promoting pain sensations. Pain nerve cell stimulation is countered or modulated in the spinal cord by inhibitory chemicals such as serotonin, norepinephrine, and opioids released from nerve cells higher in the brain. These act as natural analgesics and dampen pain sensations (Clauw, 1995). Serotonin reduces pain sensations and modulates the amount of Substance P available in tissues.

The amount of pain promoting Substance P varies in different tissues, but people with FMS show elevated levels of Substance P in spinal fluid but relatively normal levels in the bloodstream. As it turns out, blood contains high levels of substances (enzymes) that degrade Substance P, which may account for not seeing high levels in blood. However, these degrading substances are markedly lower in bladder, nose, and lung tissues, leading to the speculation that excess Substance P in these structures without high levels of breakdown enzymes could promote irritative symptoms such as irritable bladder, running nose (rhinitis), and hoarse throat (laryngitis), all symptoms prevalently associated with FMS.

As well, people with FMS exhibit low blood levels of pain-reducing serotonin and its breakdown product (5-hydroxyindoleacetic acid), and low spinal fluid levels of a building block for serotonin (tryptophan). However, serotonin levels have not been shown to correlate with pain and have been more predictive of depressed mood than pain, and paradoxically high levels are present in other painful conditions (Clauw, 1995).

Furthermore, the picture is more complicated in that other pain-related chemicals have also been implicated in FMS. For example, the pain-producing effects of Substance P might be potentiated through nerve growth factor, which is elevated in FMS patients (Giovengo, Russell, & Larson, 1996), as is calcitonin gene-related peptide. Nerve growth factor facilitates growth of Substance P-containing nerve cells and calcitonin gene-related peptide, which is in the same vicinity as Substance P in nerve cells, inhibits breakdown substances for Substance P. People with higher levels of these chemicals display more pain sensitivity. As more studies ensue, an even more complex picture of chemical imbalances no doubt will emerge.

Although the stress nervous and hormone systems and the pain biochemical lines of research mainly have occurred separately, emerging lines of investigation are connecting the two, based on how the stress and immune systems interact. For example, release of the stress hormones, norepinephrine and epinephrine, inhibit type 1/pro-inflammatory cell chemicals (called cytokines), such as interleukin (IL-12), tumor necrosis factor-alpha, IL-1, IL-8, and interferon-gamma by immune cells, whereas they stimulate the production of type 2/anti-inflammatory cytokines such as IL-10 and transforming growth factor-beta. Therefore, stress activation or the failure of normal stress activation can alter the immune balance of substances that promote or inhibit the inflammatory component of an overall systemic defense response. In patients with FM, increases in cytokines, for example, IL-8, which promote pain and whose release is stimulated by Substance P, have been observed over time. Much more study is necessary to fully outline the connection between stress and immune function.

## SUMMARIZING SPECULATIONS IN UNDERSTANDING FMS

Piecing together a comprehensive biobehavioral explanation for FMS remains elusive, but certain speculations are warranted. The set of lifestyle and behavioral contributing factors is likely to vary across individuals. Any full explanation will involve highly complex hormonal and cellular chemical interactions, involving much more than any one organ system but certainly the diffuse stress and immune systems. It is likely that some individuals have a genetic propensity to display a highly activated and/or unrelenting stress psychophysiological profile as they are exposed to

and have to cope with life challenges. Particularly vulnerable to ultimately manifest FMS are people who experience intense emotional life strain (e.g., abuse) and/or who are driven to high levels of intellectual and physical performance.

A heightened stress activation pattern incorporates the stress nervous system and stress hormones through alterations that involve imbalances of various inflammatory/immune defense cellular components within bodily tissues (e.g., cytokines), and within brain and spinal cord nerve tissues (e.g., neurotransmitters and neuromodulators). This engenders a heightened sensory sensitivity with a shift to experiencing pain upon exposure to previously nonpainful sensory input (pressure, movement) and a variety of other symptoms. While this stress-related emotional arousal and physiological activation pattern likely goes undetected over time, it could progressively intensify or worsen over time to a point where it eventually fails to be adequately or normally responsive to challenges, physical or emotional, perhaps due to prolonged stress exposure or inherent style coupled with reduced efficiencies in re-regulating components that come with aging. Thereby, an extraordinary challenge will result in (trigger) acute manifestations of FMS, followed by a lengthy recovery time during which manifestations might ebb and flow.

Clearly, FMS represents a condition in which personal styles, emotions, and behaviors are interlocked with bodily physical functions in ways that can lead to illness but in ways we do not yet fully understand enough to prevent or treat as adequately as we might. FMS, closely linked to CFS, is still a mystery—only to be solved through further multivariate studies.

—Joan L. Shaver

See also CHRONIC ILLNESS: PSYCHOLOGICAL ASPECTS;  
FIBROMYALGIA SYNDROME: COGNITIVE-BEHAVIORAL  
TREATMENT

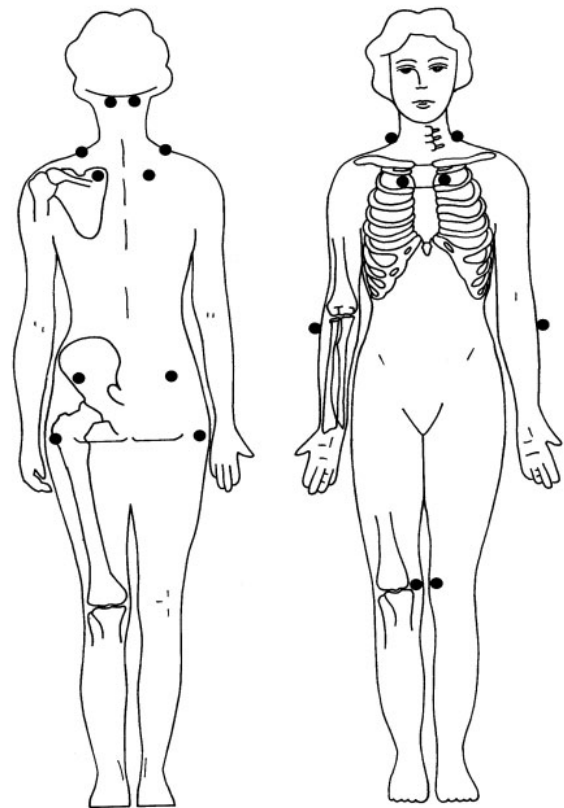
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## FIBROMYALGIA SYNDROME: COGNITIVE-BEHAVIORAL TREATMENT

Fibromyalgia syndrome (FMS) consists of a pervasive set of unexplained physical symptoms with generalized pain and hypersensitivity to palpation at specific body locations (tender points, or TPs; Wolfe et al., 1990; see Figure 1) as the cardinal features. In addition, patients report persistent fatigue, sleep disturbance, feelings of stiffness, depression, anxiety, cognitive impairment, and general malaise sometimes referred to as "fibro fog" (Baumstark & Buckelew, 1992). FMS may have an insidious onset without any identifiable cause, may develop following a flu-like illness, or may rapidly develop following a trauma such as a motor vehicle accident or emotional distress (Clauw & Chrousos, 1997; Turk, Okifuji, Starz, & Sinclair, 1996).



**Figure 1** Location of Tender Points

SOURCE: Okifuji, Turk, Sinclair, Starz, and Marcus (1997).

The population prevalence of FMS is estimated to range from .66% to 10.50% (Schochat, Croft, & Raspe, 1994). The variability in prevalence may result from differences in classification criteria since not all of these studies used the American College of Rheumatology criteria (Wolfe et al., 1990). Bennett (1995) estimated that approximately 5 million Americans have FMS. FMS is more commonly observed in women, with a female to male ratio of 7 to 1 in those seeking treatment. In community samples, however, the ratio is closer to 3 to 1, females to males.

## THE TORMENT OF FMS

Beyond the pain and related symptoms, health care providers or the legal system confronts FMS sufferers with a poorly understood disorder that is not well accepted. The lack of objective medical findings to confirm the diagnosis can result in confusion and frustration. Interpersonal relationships often suffer as the

impact of FMS extends beyond the physical to affect the emotional, occupational, social, and recreational areas. As symptoms affect more and more of the person's life, psychosocial and behavioral factors come to play an expanding role.

There is growing consensus that FMS reflects an abnormality in central processing of noxious sensations characterized by hypersensitivity to stimulation. In general, biopsychosocial models of pain have been proposed to integrate physical, psychosocial, and behavioral contributions to pain perception and adaptation (Turk & Sherman, 2002).

## GENERAL TREATMENT RECOMMENDATIONS

Although FMS has some unique characteristics, many of the traditional cognitive and behavioral interventions have been adapted for use. This entry describes the application of the cognitive-behavioral therapy (CBT) approach highlighting some of the specific features that are particularly important.

### Education

Information and reassurance are essential for treating FMS. The lack of a definitive explanation for the symptoms often produces fears that something serious, but as yet unidentified, is causing the symptoms; that the symptoms will become progressively worse; of being told that there is nothing that can be done; of being told that the problems are all caused by psychological factors (i.e., "imaginary and all in their heads"); and that they will be told to learn to live with symptoms without being told how. Consequently, it is essential that treatment begin with information about the nature of FMS, the possible causes, and the contributions of emotional, behavioral, and cognitive factors, as well as physical contributions.

Education includes a discussion of the distinction between acute pain and chronic pain. Acute pain is rightly seen as a signal of *harm* or potential damage or danger to the body. In the case of FMS, however, the pain is no longer a signal of damage to the body. Thus, it is important to make the distinction between *hurt* and *harm*. Patients are informed that they will be asked to increase physical activity and exercise. The clinician should acknowledge that a conditioning program will likely cause some increase in the level of pain as muscles become sore after months or years of disuse but that the exercises will cause no permanent damage.

### Focus on Function, not Cure

Patients with a rigid conviction that something is physically wrong and needs to be corrected can often obstruct treatment of FMS as it reinforces a passive role that will impede acceptance of self-management and subsequently progress toward improved physical and psychological functioning. If patient and therapist agree to embark on treatment, therapy should always focus on reduction of emotional distress, functional gains, and improvement in quality of life, rather than on complete elimination of symptoms and cure.

### Goal Setting

Clinicians should focus on goal setting as a means to direct behavior into achievable, reinforcing objectives. Goal setting achieves multiple purposes. First, people with FMS need to have realistic goals. If a patient enters treatment with the goal of being "pain free" and "just like I was before I developed FMS," then treatment should focus first on education about FMS, a discussion about how treatment for FMS involves making significant lifestyle changes, pacing resources, and maintaining these changes despite symptom flare-ups and remissions.

A second function of goal setting is to provide an evaluation of the concordance between the patients' expectations and those of their health care provider. Clinicians must ensure that treatment goals are mutually understood and acceptable. Lack of acceptance will undermine motivation and impede both progress and successful outcomes. Clinicians should emphasize a collaborative relationship. Together the therapist and clinicians should work to identify achievable goals that are measurable and within the patient's control.

### Relaxation

Relaxation is an integral part of the self-management program for FMS patients. There are many different methods to help patients learn to relax (e.g., controlled breathing, progressive muscle relaxation, autogenic training), no one of which is better than any other. Moreover, different people will find different methods more appealing. Thus, the therapist should work with patients to help them learn which methods can be most useful for the individual patient.

## Imagery

One of the most commonly used means of diverting attention from symptoms is focusing attention on events external to sensations. Clinicians may teach imagery as a strategy that patients may use when they are feeling overwhelmed by their symptoms and distressing aspects of their lives.

The clinician should inform patients that the use of imagery, as well as relaxation, will become easier with practice, just like any other skill. The clinician teaches the patient to include all senses to enhance the vividness of images. The clinician should attempt to create a “no lose” situation by emphasizing that there are many types of images and the clinician will work with patients to find one that might be helpful. The idea is to help patients develop a repertoire of coping strategies that they can use on their own. A nonjudgmental attitude should be encouraged as the patient attempts to identify methods that can be of assistance.

## Pacing and Increasing Activities

FMS patients often anticipate that physical activity will cause pain and further damage. Consequently, they avoid activities for fear they will make themselves worse (Vlaeyen et al., 1997). This may lead to avoidance of activity to prevent more pain, fatigue, and injury. Treatment should focus on breaking the association between activity and anticipated pain by encouraging patients to gradually increase the pace of their activity. Patients are encouraged to understand that through their efforts, they will increase the level of endurance and reduce fatigue.

A pacing exercise calls for patients to establish a daily time quota for a particular activity, and to spend only the preset amount of time on the activity. Patients are asked to perform the activity for several days, up to the point where they are beginning to feel pain, fatigue, or any other sign that they have reached their limit. Using this as a baseline, the therapist helps the patient to create a manageable activity plan, with gradually increasing activity levels that patients are likely to be able to maintain.

## Sleep

A common symptom reported by FMS patients is poor sleep. The clinician should encourage patients to establish a sleep hygiene plan that consists of: a standard wake-up time, getting out of bed during extended

periods of being awake, avoiding sleep-incompatible behaviors in the bed, eliminating daytime napping, and avoiding activities and foods (e.g., caffeine, alcohol) consumed near bedtime that might interfere with sleep.

## Cognitive Dysfunction

Many patients with FMS report difficulty concentrating, attending to new material, and less frequently, difficulty with short-term and long-term memory (Glass & Park, 2001). The attention and concentration deficits may be more related to sleep deficits, medication, physical deconditioning, and depression than to FMS itself (Landro, Stiles, & Sletvold, 1997). Perceived memory deficits reported by FMS patients are often disproportionately greater than their objective deficits determined by cognitive testing (Grace et al., 1999).

## Maladaptive Thoughts

Many people with FMS subscribe to a number of negative and maladaptive thoughts about themselves and their plight. Clinicians should directly address the relationship between thoughts, feelings, behavior, and physiology. To assist in the discovery process, patients may be asked to complete a diary recording when their symptoms are worse, what they were doing, what they were thinking, how they felt, and how their thoughts and feelings affected what they did.

Clinicians may use an *ABCD* model to help the patient identify and alter maladaptive thoughts and behaviors: *activating* event or stressor, *belief* system (thoughts and attitudes) about the stressful event, *consequences* of the activating event (feelings) and a way to change the above sequence of events, and *disputing* the negative thinking discovered in *b*, which can affect how badly people feel in *c*.

## Stress

Many patients with FMS fail to see the relationship between stress and their physical health. Clinicians should assist patients to identify stressors and distinguish between stressors they can or cannot control. Emphasis can be placed on modifying the stressors that patients can control and practicing other skills such as relaxation, time management, and effective communication for those stressors that they cannot control.

**Table 1** Subgroups of Chronic Pain Patients Based on the Multidimensional Pain Inventory Relative to Other Chronic Pain Patients*Dysfunctional patients report*

- Higher levels of pain
- Higher levels of perceived interference of pain with their lives
- Higher levels of emotional distress
- Lower levels of perceived control over their lives
- Lower levels of activity

*Interpersonally distressed patients report*

- Lower levels of perceived support
- Higher levels of negative (punishing) responses from significant others
- Lower levels of solicitous responses from significant others
- Lower levels of distracting responses from significant others

*Adaptive copers patients report*

- Lower levels of pain (although still seeking treatment)
- Lower levels of perceived interference of pain with their lives
- Lower levels of emotional distress
- Higher levels of perceived control over their lives
- Higher levels of activity

SOURCE: Turk and Rudy (1988).

## Relapse

FMS is a chronic condition and symptoms will fluctuate between relative reductions in symptoms and flare-ups, hence the emphasis on pacing noted previously. As a consequence, a relapse prevention model is important. Clinicians should present this as a process where people can find themselves relapsing and need to reinstitute their self-management plan. They acknowledge that there will be good and bad days as everyone experiences “ups and downs.” The key to consistent recovery is not the absence of symptoms but the willingness to reenter the process of recovery with independent action even after a flare-up.

The challenge for patients is twofold, first, to recognize when they are relapsing and second to return to the use of their self-management skills. Patients can be asked to list the behaviors, thoughts, and feelings that act as cues or predictors that a relapse is likely to occur. They are then asked to list the behaviors that have helped in the past and to develop a written plan for engaging in those behaviors. Patients can be encouraged to think of factors that might contribute to flare-ups and to identify and anticipate *high-risk* circumstances. If they can identify some, they can attempt to alter them, avoid them, plan on how to respond to them, or accept them as inevitable and plan how they will accommodate their activities when flare-ups do occur.

## PATIENT HETEROGENEITY

A number of investigators have suggested that FMS patients are not a homogeneous group. Turk and Flor (1989) suggested that FMS might consist of several patient subgroups with different constellations of physical and psychological features. They argued that delineation of the relevant subgroups would facilitate the identification of the mechanisms underlying the symptoms of FMS and the development of treatments customized to address specific needs of different patient groups.

Turk and Rudy (1988) developed an empirically derived taxonomy of chronic pain patients based on patients' responses to the West Haven-Yale Multidimensional Pain Inventory (MPI; Kerns, Turk, & Rudy, 1985)—dysfunctional (DYS), interpersonally distressed (ID), and adaptive copers (AC) (see Table 1).

Turk, Okifuji, Sinclair, and Starz (1996) found that the majority of FMS patients (87%) can be classified into one of the three primary groups: *DYS*, *ID*, and *AC*, with approximately one third classified in each group. The distinct characteristics associated with each patient subgroup suggest that prescription of a uniform intervention for all patients might result in less than optimal outcomes since the specific needs of some patients will not be directly addressed. It may

be more appropriate to customize treatment to meet their specific clinical needs (Turk, 1990). For example, although the patients in both DYS and ID groups were depressed, depression in the latter group may be closely related to marital and interpersonal problems. Meaningful improvement, therefore, may not be achieved without addressing interpersonal or marital issues for ID FMS patients. Being able to prescribe specific treatments based on patient characteristics, rather than the more typical "one size fits all" approach, is likely to benefit a greater number of patients and ultimately to be more cost-effective. The clinical value of customizing treatment to the three subgroups identified has recently been demonstrated in several studies (Strategier, Chwalisz, Altmaier, Russell, & Lehmann, 1997; Talo, Forssell, Heikkonen, & Puukka, 2001; Turk, Rudy, Kubinski, Zaki, & Greco, 1996).

### Interpersonal Problems

A significant number of patients with FMS fit the ID profile on the MPI (Turk, Okifuji, Sinclair, & Starz, 1996). People with such profiles show high levels of pain and depression and report low social support or high levels of negative or punishing responses from significant others. For these people, treatment needs to include effective communication skills to facilitate cooperation with others. This is a fairly unique group, and little attention has been given to helping them address problems associated with interpersonal relationships.

Role-playing may be used to help ID patients learn more effective means of communication and interpersonal problem solving. Assertiveness training is particularly important for assisting people in making their different attitudes and behaviors actually work in their interpersonal contexts. For example, as one shifts from an attitude of feeling responsible for everything to a perspective that allows for acknowledgment of limits and asking for help, she or he may need to learn new communication skills to facilitate cooperation from others, including family and friends.

Partner or family counseling may be appropriate for ID patients. Significant others (e.g., spouses, other family members, partners) can be taught how they can be most helpful to the affected person, whether through instrumental, direct problem-solving support, or through emotional support and validation of the person's experience and efforts.

### CONCLUDING COMMENTS

Preliminary studies using a CBT approach have been generally positive in reducing symptoms and related distress, but not in eliminating all symptoms of FMS (e.g., Nielson, Walker, & McCain, 1992; Turk, Okifuji, Sinclair, & Starz, 1998; Turk, Okifuji, Starz, & Sinclair, 1998). Larger-scale studies with appropriate control groups and adequate follow-up periods are required to confirm the effectiveness of CBT. Research is needed to determine what set of FMS patients, with what characteristics, can benefit from generic CBT combined with activity therapy. The failure of many patients to achieve and maintain positive outcomes indicates, most assuredly, that one size does not fit all.

—Dennis C. Turk

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See also CHRONIC ILLNESS: PSYCHOLOGICAL ASPECTS;  
FIBROMYALGIA SYNDROME: BIOBEHAVIORAL ASPECTS

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## 5 A DAY—FOR BETTER HEALTH! PROGRAM

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The 5 a Day—for Better Health! Program is a large-scale national public/private partnership health promotion program that encourages all Americans to increase their fruit and vegetable intake to 5 to 9 servings daily for good health. The program seeks to achieve broad environmental change as well as individual behavior change by using a comprehensive mix



of multidimensional (physical, social, behavioral, and spiritual) strategies to achieve and sustain impact. The program emphasizes working through multilevel (national, regional, and community) health and industry organizations to positively affect the entire nation's fruit and vegetable intake, resulting in a large public health impact.

#### DIET-DISEASE LINK

A high intake of fruits and vegetables decreases the risk of certain types of cancer, cardiovascular disease, and other chronic diseases. In fact, diets high in fruits and vegetables (including at least 5 servings daily) alone may prevent 20% or more of all new cases of cancer worldwide (World Cancer Research Fund, American Institute for Cancer Research, 1997). Similarly, diets high in fruits and vegetables are associated with a decreased risk of coronary artery disease and stroke. Emerging research suggests a role for fruits and vegetables in reducing the risk of obesity and diabetes.

The evidence that a variety of fruits and vegetables may contribute to the prevention of cancer, heart disease, and other chronic diseases is drawn from hundreds of population and laboratory studies. Fruits and vegetables are sources of vitamins and minerals, carotenoids and other antioxidants, and various phytochemicals that separately or in combination, affect plausible biological mechanisms for reducing the risk of chronic diseases. The overwhelming weight of the evidence has led to a major focus on fruit and vegetable consumption in U.S. federal nutrition policy and educational/behavior change initiatives.

#### 5 A DAY—FOR BETTER HEALTH! PROGRAM STRUCTURE

The national 5 a Day—for Better Health! Program objectives include (1) increasing public awareness of the need to consume at least 5 servings of fruits and vegetables and (2) providing consumers with specific information on how to include more fruits and vegetables into their daily eating patterns. The use of a trademarked logo (see Figure 1) and a licensing process to obtain formal commitment is unique to the 5 a Day program and has been essential in conducting a program of this magnitude. The legal documents provide the basic rules and an unwavering framework from which each partner can create its own signature 5 a Day program.



**Figure 1** 5 a Day Trademarked Logo

All licensed participants use the logo to identify their affiliation with the national 5 a Day program.

The National Cancer Institute (NCI), after funding the initial state-based California 5 a Day program, initiated the national 5 a Day program in 1991 as a large-scale, public/private partnership with the Produce for Better Health Foundation (PBH) to reduce the risk of cancer and other diseases in the United States. PBH, a nonprofit nutrition education foundation representing the fruit and vegetable industry, has licensed approximately 1,000 industry members, including retailers, growers, shippers, packagers, merchandisers, commodity boards, trade associations, and producers of branded products, to conduct 5 a Day efforts at the community level. The retailers represent more than 30,000 supermarkets across the country. NCI has licensed all 50 state health departments, the health promotion programs of the uniformed services, and the Indian Health Service to develop 5 a Day health promotion programs.

The program was founded on the idea of a collaborative promotion by the entire fruit and vegetable industry, with scientific and intervention support from the government health partners. Since 1991, the partnership has grown to include many state and national government agencies with an interest in dietary behavior change, such as the Centers for Disease Control and Prevention (CDC), the U.S. Department of Agriculture (USDA), and nongovernment health organizations, such as the American Cancer Society (ACS). The organizational structure of the multilevel,

public/private partnership is one in which public and private sectors work together at the national, state, and local levels through a variety of intervention channels.

Internationally, the 5 a Day program public/private partnership model has been applied in several countries, including Australia, Canada, Denmark, Germany, Hungary, the Netherlands, New Zealand, Norway, and Sweden. Key elements identified for successful programming include strong public/private partnerships; evidence-based governmental nutrition policy; a simple, actionable message; a clearly defined target audience; and a plan for program evaluation.

### LINKING THEORY, RESEARCH, AND PRACTICE

From the inception of the program, current theories of behavioral change have been incorporated into program planning. Theory-driven community-based behavioral change and communication research projects were funded and carried out, and more recently, plans for wide-scale dissemination of evidence-based practice are being instituted. This feedback of continuous theoretical and research evidence strengthens and invigorates the program.

The main behavioral theories that were selected to guide the national 5 a Day program were the health belief model, with a focus on a person's perception of a health threat and the assessment of recommended behaviors for prevention (Janz & Becker, 1984); social cognitive theory, which proposes that behavior is explained by a dynamic reciprocal theory whereby personal factors, environmental influences, and behavior continually interact (Bandura, 1977, 1986); and the transtheoretical or stages of change model, which addresses an individual's readiness or attempt to change toward healthy behaviors (Prochaska, DiClemente, & Norcross, 1992). Theoretical constructs were incorporated into the guidelines for all licensed program participants, and a strong theoretical design is a crucial aspect of all 5 a Day-related behavioral change research and interventions.

### PROGRAM COMPONENTS

Message and behavioral change activities are disseminated through four main program components: media and communications, industry initiatives/point-of-sale interventions, community-level programs, and research and evaluation efforts. Using social marketing

techniques and theory-based strategies, the 5 a Day program partners work individually and collaboratively to develop, implement, and evaluate a variety of interventions.

### Mass Media and Communications

Mass media (newspapers, magazines, television, radio, and the Internet) reach large segments of the population and provide opportunities to deliver messages that encourage behavior change. The 5 a Day communications component uses an audience segmentation, social marketing approach based on the consumer-based health communications (CHC) model (Lefebvre et al., 1995). The stages of change theory was employed to help the program assist consumers in moving along the behavior change continuum from creating awareness of the need to eat 5 or more servings of fruits and vegetables, to providing skill-building tips for preparing to make a change in eating behavior, to eating more fruits and vegetables.

The sequence of strategies to shape the media campaign included initial planning using the CHC model, and formative research to determine the target audience and core messages. The 1991 baseline nationally representative telephone survey of 2,800 adults revealed that most respondents were eating approximately 3.4 servings of fruits and vegetables (not including French-fried potatoes), with one out of five eating fewer than 2 servings daily. The survey also found that only 8% of Americans were aware of the need to eat at least 5 servings of fruits and vegetables for good health. This information served as the cornerstone for the national media launch. Focus group research and market research data defined the target media audience as "adults, currently eating about three servings or less of vegetables and fruits and trying to consume more." The core message strategy for this target audience was to increase self-efficacy and skills by teaching the target audience how to "add two or more servings of vegetables and fruits a day 'the easy way' instead of making it hard."

With an NCI annual media budget range of \$1-\$1.5 million during the first 10 years of the program, a presence in paid media was not possible. However, with the advantage of the NCI imprimatur, the decision was made early to deliver messages through unpaid media placements and to devise strategies that would ensure sufficient media penetration. The strategy of focused messages, repeated often and consistently,

with new and updated approaches to keep the target audience interested and engaged, was employed. The program used a variety of media approaches to reach the broadest audience possible with limited resources. Multiple media vehicles have included news columns and magazine articles to television and radio programming and Web sites. An additional resource of media placement by state and local health partners multiplied the message penetration and helped in tailoring the message for diverse audiences. Some of the themes and graphics used for National 5 a Day Week have reflected findings from consumer research. For example, “The Original Fast Food” theme and graphic were created to emphasize the ease and convenience that fruits and vegetables offer to the busy target audience, who want to eat healthfully but have little time to plan. The “Sample the Spectrum” theme and graphic translate emerging science on phytochemicals in an easily understood way to the public and encourage Americans to consume 5 to 9 daily servings of colorful fruits and vegetables.

Tracking and evaluation are consistently conducted throughout the media campaign to track progress, redirect strategies, and fine-tune tactics. Tracking and evaluation projects include media content analysis, omnibus surveys to track awareness, research audits, and target audience analysis. Omnibus awareness surveys have shown that awareness of the 5 a Day message increased from 22% in 1992 to 35% in 1999.

In the first decade of the national program, the media campaign targeted the general adult population. Given today’s awareness of the needs of the medically underserved populations, the 5 a Day program is redirecting its communications focus to target those populations with a disproportionate incidence of cancer and other chronic diseases. For example, the 2002–2003 communications strategy focuses on African American males, whose cancer rates are disproportionately greater than other demographic groups.

### **Produce Industry Initiatives/Point-of-Sale Initiatives**

A strong point of the national 5 a Day program is the unique partnership between the fruit and vegetable industry and the public health community, whereby all benefit from increased sale and consumption of fruits and vegetables. The overwhelming value of the produce industry to the public health community is realized in marketing dollars and a viable point-of-sale

venue whereby all Americans can be reached with the 5 a Day message. The industry benefits from the scientific credibility and public health infrastructure that government health agencies bring to the partnership.

The use of supermarkets’ marketing power is a powerful way to reach consumers through ads, circulars, and in-store interactive educational activities. The majority of the large U.S. supermarket chains are licensed and active partners of the program. Most supermarkets provide 5 a Day signage and educational materials, include the logo with health messages in newspaper advertising, and conduct promotional activities throughout the year. As an example, the largest wholesale food distributor (more than 5,000 stores) conducts a yearly 5 a Day merchandising contest among its stores. Stores participating in the contest increased their sales as a result of the displays and activities. Another large chain conducts a twice-yearly elementary school children’s 5 a Day and Physical Activity promotion in all of their stores. Each store “adopts” a school and provides funding for health promotion events.

Noncommercial food service, that is, school and worksite cafeterias and other noncommercial venues, have worked extensively with public health partners to change the food service environment to be more supportive of fruit and vegetable consumption. Many schools have instituted salad bars and increased produce availability in school breakfast and lunch.

### **State and Community Programs**

The state and community 5 a Day programs primarily function under the leadership of coordinators in each of the 50 state health departments, using existing public health nutrition funding and voluntary industry in-kind support. Most states have developed coalitions comprising representation from the public and private sectors. Coalition members include state and regional representatives of the national-level steering committee members, such as state departments of agriculture, cooperative extension services, and ACS regional offices; state departments of education; voluntary agencies; hospitals and cancer centers; licensed 5 a Day industry participants; and others. Collaboration among partners helps to reach consumers more effectively, maximize the use of scarce resources, coordinate state and national media efforts, encourage innovations, and create working relationships between the public and private sectors.

Schools, worksites, and supermarkets are commonly used intervention channels for disseminating 5 a Day activities. A major effort is currently being expended to identify funding sources for 5 a Day state and community interventions, as part of ongoing activities or new initiatives.

### Research, Dissemination, and Evaluation

Research and evaluation are integral components of the program, and essential for long-term success. The NCI, USDA, CDC, ACS, PBH, and other national organizations fund research projects in communications, program evaluation, and nutrition and behavioral change to increase fruit and vegetable consumption. Efforts to disseminate the evidence-based strategies from these and other studies to practitioners throughout the 5 a Day infrastructure are a priority.

The cornerstone of 5 a Day research is the set of nine community-based research studies with randomized designs funded in 1993-1997 by the NCI to implement and evaluate interventions aimed at increasing fruit and vegetable consumption among specific population segments in specific community settings. The intervention channels and populations were schools, worksites, food assistance programs, and churches targeting African Americans, Hispanics, people with low income, children, and others. Across the studies, statistically significant positive changes in fruit and vegetable consumption ranged from 0.20 to 1.68 servings per day, with an average effect size of 0.68 servings per day. These studies were successfully implemented and substantially increased understanding of how to motivate healthful eating behaviors in a variety of settings and in diverse populations.

Evaluation research focused on the national 1991 baseline and 1997 follow-up surveys to measure fruit and vegetable consumption and the corresponding psychosocial factors. In addition, a process evaluation was performed to document programmatic growth and activities at the state and local levels. The difference between the baseline and follow-up surveys showed an overall modest increase of 0.23 servings of fruit and vegetable consumption from 1991 to 1997. However, the 1997 estimated mean fruit and vegetable intake of approximately 4 servings in the adult U.S. population is still a full serving short of the minimum 5 a Day goal. This same survey showed a significant ( $p < .05$ ) increase in those consuming 5 or more servings

daily (23-27%), and a significant increase in those aware of the 5 a Day message (7-20%).

### SUMMARY

The multifaceted 5 a Day—for Better Health! Program has grown to be the largest public/private partnership public health nutrition and behavior change program in the world. Over the first decade of the 5 a Day program, the following have occurred: (1) Fruit and vegetable consumption has shown a positive trend; (2) awareness of the 5 a Day message increased significantly; (3) state 5 a Day coalition infrastructures are in place and are composed of a variety of members from public and private sectors; (4) efforts to expand to a national steering committee leadership are well under way; and (5) research shows that changing fruit and vegetable consumption behavior is possible.

—Gloria Stables

See also CANCER AND DIET; HEART DISEASE AND DIET

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## FRAMINGHAM HEART STUDY

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The Framingham Heart Study is the oldest and perhaps best-known population study in the United States. In 1948, a group of medical researchers entered the New England town of Framingham, Massachusetts (population about 68,000), to begin one of the largest and most important epidemiological studies in the history of medicine. Framingham is an average Massachusetts town, not far from Boston. In fact, it is along the course of the Boston Marathon.

The purpose of the Framingham Heart Study was to determine the causes of stroke and heart failure. Before the Framingham study, most investigations of heart disease had been retrospective. Retrospective studies start with a group of people who have already developed heart trouble and then look into their pasts to determine what they had in common. In contrast, the researchers in the Framingham study started with healthy people and attempted to predict which ones would eventually die of heart and circulatory problems. This approach is called prospective and is considered to produce superior and more convincing

scientific data than the retrospective method. The study began by identifying every other man and woman in Framingham between the ages of 30 and 60 who had no signs of heart disease. In the beginning there were 5,127 participants. Each time a new subject was enrolled, he or she was given a thorough physical exam and a detailed interview about lifestyle. The subjects were remeasured every 2 years.

Numerous findings from the Framingham Heart Study have influenced medicine and public health. For example, in 1960, investigators from the Framingham project reported that cigarette smoking increased the risk for heart disease. Prior to that, most attention had been focused on the relationship between tobacco use and cancer. In 1961 results from the Framingham study were among the first to demonstrate that elevated levels of cholesterol, blood pressure, and abnormalities in electrocardiograms were associated with the risk of heart disease. By 1997, the Framingham study demonstrated that physical activity and exercise reduced the risk of heart disease and that obesity increased the risk of heart disease. The Framingham study evaluates other health outcomes in addition to heart disease. In 1970, data from the study convincingly demonstrated that elevated blood pressure increases risk of stroke. In 1976, a report from the Framingham study was among the first to clearly document that the risk of heart disease in women increases at the time of the menopause.

By 1988, the study had demonstrated that not all levels of cholesterol are the same. High-density lipoprotein (HDL) cholesterol was found to be a particularly important protective factor. As the study progressed, more sophisticated methodologies were employed. For example, evaluations of enlargement of the left ventricle, which is one of the two lower chambers of the heart, was shown to increase the risk of stroke in a 1994 publication from the Framingham study. In 1996, data from the study was used to demonstrate how high blood pressure progresses toward heart failure.

The Framingham Heart Study is now used to study many different chronic diseases. For example, there have been significant publications on diabetes, dementia, arthritis, and other problems. In addition, the study has been used to evaluate new risk factors for heart disease. For example, in 1990 the study demonstrated that homocysteine (an amino acid) may be an important risk factor for heart disease.

The Framingham Heart Study has also produced many findings relevant to psychosocial outcomes. The

Framingham study was among the first to demonstrate relationships between personality factors, including Type A behavior and heart disease in a 1978 publication. Clearly, some predictors of heart disease are beyond the subject's control, such as age (older people are more prone), sex (males are more prone), certain diseases such as diabetes, and race (Blacks are more prone). However, a major finding of the study was that some of the best predictors of heart disease and early death are direct consequences of behavior. These predictors of heart disease include smoking, obesity, high cholesterol level (perhaps associated with a high animal fat diet), physical inactivity, and possibly excessive tension and stress.

The Framingham Heart Study has been very important in establishing that some risk factors for heart disease are mutable, or subject to change. Thus, much of the current practice of preventive medicine was launched. Risk factors were identified, and important recommendations for behavior change were offered. The Framingham Heart Study has continued to follow the original group of participants. After more than 50 years, the study continues to contribute scientific insights. In addition, the study has been expanded to include the offspring of the original participants and, more recently, their grandchildren.

In summary, the Framingham Heart Study is one of the most significant epidemiological studies ever conducted. The study is funded by the National Heart, Lung, and Blood Institute and is expected to be an important contributor to our understanding of chronic disease for years to come.

—Robert M. Kaplan

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## FUNDAMENTAL SOCIAL CAUSES OF DISEASE AND MORTALITY

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The primacy of social conditions as determinants of health has been observed for centuries. In the 19th century, Virchow (1848) declared that “medicine is a social science.” Today, social epidemiologists articulate the centrality of “upstream causes” of disease and death. The concept of fundamental social causes adds to these statements the idea that explanations for the influence of social conditions on health cannot be reduced to the mechanisms that happen to link the two at any particular place or time.

To argue that social conditions are irreducible fundamental causes is more than an intellectual issue concerning the proper understanding of the role of social conditions in health. This argument also implies that policy seeking to ameliorate health disparities *must* address the social conditions that produce them. Addressing only the mechanisms will reliably fail to address health disparities.

This entry uses socioeconomic status (SES) to exemplify the theory of fundamental causes. A strong association exists between indicators of SES (education, occupation, and income) and mortality (Antonovsky, 1967; Sorlie, Backlund, & Keller, 1995). Clearly, biological mechanisms are involved in the SES-disease association. Just as clearly, other mechanisms must be involved—disease does not seep directly from income, educational, or occupational statuses into the body. Nevertheless, this entry argues that the effect of SES on mortality cannot be eliminated by addressing the mechanisms that link the two at any particular time. In this regard, one of the most striking features of the SES-health association is its persistence across time and place. It was present in the early 19th century in Mulhouse, France, in Rhode Island in 1865, and in Chicago in the 1930s (see Antonovsky, 1967) and is present in Europe and the United States today (Kunst et al., 1998; Lantz et al., 1998; Sorlie et al., 1995). Considering the vast differences in life expectancy, risk factors, diseases, and health care systems characterizing these different places and times, the persistence of the SES-mortality association is remarkable. Indeed, it is this persistence that suggests the irreducible nature of SES as a fundamental cause.

To proceed with our reasoning, imagine a causal model with SES as the distal factor linked to death by more proximal risk factors. If the proximal risk factors are eliminated, we would expect the SES-mortality association to be eliminated also. On the contrary, we have seen important instances in which major proximal risk factors were eliminated while SES disparities in mortality persisted. In the 19th century, overcrowding, poor sanitation, and widespread infectious diseases such as diphtheria, measles, typhoid fever, tuberculosis, and syphilis appeared to explain higher mortality rates among less advantaged persons. But the virtual elimination of those conditions and diseases in developed countries did not diminish SES inequalities in mortality (Rosen, 1979). In the 20th century, national health programs, providing free

medical care to all citizens, were instituted with the express purpose of radically diminishing another mechanism understood to be an important link between SES and health—differential access to health care. Again, SES disparities in mortality remain undiminished decades after these programs were adopted (Black et al., 1982). In both cases, mechanisms “explaining” the SES-mortality association were dramatically modified, independent of SES. Our causal-model approach would predict a substantial reduction in the association between SES and mortality, but this did not happen.

A ready answer to this puzzle is that the previous mediating risk factors have been replaced by others, such as health behaviors and psychosocial stress (Adler et al., 1994). This situation calls to mind Lieberman’s (1985) description of “basic causes,” which have enduring effects on a dependent variable because, when the effect of one mechanism declines, others emerge or become more prominent. House and colleagues first suggested that such a process might explain the enduring SES-mortality association (House et al., 1990). Lieberman’s notion of basic causes provides a critical insight for understanding the tenacity of the SES-mortality association, but it does not tell us what it is about SES that allows it to reproduce its effects despite the elimination of intervening mechanisms.

Link and Phelan (1995) argued that new mechanisms arise because higher-SES persons enjoy a wide range of resources, including money, knowledge, prestige, power, and beneficial social connections, that can be used to one’s health advantage. These resources directly shape individual health behaviors by influencing whether people know about, have access to, and can afford to engage in health-enhancing behaviors. Resources also shape access to contexts such as neighborhoods, occupations, and social networks that dramatically vary in their profiles of risk and protective factors. Thus, the processes implied by the fundamental-cause perspective operate at both individual and contextual levels.

This background allows us to specify the essential components of a fundamental cause of morbidity and mortality: First, it influences multiple disease outcomes. Second, it operates through multiple risk factors. Third, the association between the fundamental cause and mortality is reproduced over time via the replacement of intervening mechanisms. Finally, the “essential feature of fundamental social causes is that

they involve access to resources that can be used to avoid risks or to minimize the consequences of disease once it occurs” (Link & Phelan, 1995, p. 87). Because of the general nature of these resources, they are adaptable to changing health-related conditions and can be used to protect health no matter what the current risks, treatments, or diseases are.

## EVIDENCE

The first two propositions are strongly supported by existing data. Low SES has been related to numerous risk factors for disease and death, for example, smoking, sedentarism, being overweight, and excessive alcohol consumption (Lantz et al., 1998); stressful life conditions and social isolation (House & Williams, 2000; Turner, Wheaton, & Lloyd, 1995); preventive health care (Link et al., 1998); crowded, unsanitary living conditions; and malnutrition (Rosen, 1979). Low SES is also related to a multiplicity of diseases and other causes of death. For example, low SES is related to each of the 14 major causes of death in the International Classification of Diseases (Illikey & Mullen, 1985).

The third proposition is that the SES-morbidity/mortality association is reproduced through the replacement of mechanisms. Consonant with this proposition, historical evidence shows a consistently strong SES gradient in mortality since the 18th century (Antonovsky, 1967) concomitant with dramatic changes in the risk factors linking SES and mortality over this time. Moreover, there are important instances in which SES gradients in specific risk factors and disease outcomes have changed as predicted by the theory. When knowledge emerged about the benefits of a low-fat diet, higher-SES groups altered their diets more than did lower-SES groups (Popkin, Siega-Riz, & Haines, 1996). Similarly, as knowledge about the risks of smoking emerged, higher-SES people were more likely to stop or not start smoking (Pierce et al., 1989). Concomitant with these changes, the association of SES to coronary heart disease shifted from a direct to an inverse association (Beaglehole, 1990). Also, whereas lung cancer mortality was not related to SES as late as 1930, a large inverse association began to emerge in the 1950s (Logan, 1982). Until recently, breast cancer mortality was higher among higher-SES women, due to higher incidence in that group. But with better identification and treatment, the formerly positive association has

diminished, at least among White women, to near no difference (Heck et al., 1997).

More systematic analysis is needed to ensure that these examples are not a biased set of cases that happen to support the theory. Nevertheless, this evidence is supportive of the dynamic aspect of fundamental-cause theory—as knowledge about risk and protective factors changes, so do SES patterns of disease and death.

The fourth proposition concerns what we regard as the key feature of fundamental social causes: differential access to and utilization of resources. This proposition can be tested by identifying situations in which it is difficult to use resources to prolong life—when even the richest or most powerful person on earth cannot use those resources to escape death. If the utilization of resources is critical in prolonging life, then, when resources associated with higher status are useless, high SES should confer no advantage, and the usually robust SES-mortality association should be reduced. One such situation occurs when the causes and cures of fatal diseases are unknown: Socioeconomic resources cannot extend life, because we do not know how to direct those resources. A second situation occurs in old age. Death eventually comes to us all; thus, there must come a point when no amount of money, power, or other resources can overcome the biological imperative of death. Phelan et al. (1999) tested these predictions using the National Longitudinal Mortality Study and reliable ratings they developed of the preventability of death from specific causes. Consistent with predictions derived from the theory, Phelan et al. (1999) found that the SES-mortality association is much stronger for highly preventable causes than for less preventable causes and that the SES-mortality association weakens in old age when eventually no interventions can maintain life.

## CONCLUSION

The theory of fundamental social causes finds substantial support in broad historical facts and from the tests to which we have subjected it. This evidence increases our confidence in the validity of the theory. Nevertheless, the idea needs further tests that might be achieved through systematic observation of associations between SES and specific diseases over time as we learn more about those diseases. To the extent that the theory is correct and the effect of social conditions

on health is irreducible, the amelioration of health disparities must attend to the social conditions that so reliably produce them.

—Jo C. Phelan and Bruce G. Link

See also SOCIAL CAPITAL AND HEALTH; SOCIOECONOMIC STATUS AND HEALTH

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## GASTRIC ULCERS AND STRESS

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Two major loci of ulcers in the upper gastrointestinal tract are the body of the stomach (gastric ulcers) and the duodenum. This entry focuses on gastric ulcers because peptic/duodenal ulcers are dealt with elsewhere in this encyclopedia. Physiological injury to the stomach ranges from irritations of the mucosal lining (petechiae) to erosions into the stomach lining causing surface bleeding (ulcerations) to lesions that penetrate the stomach wall (perforating ulcers).

Gastric ulcers became a common medical problem in the 20th century. Ulcers are not only painful but can be life threatening. Taken together, all the medications to treat ulcers are currently the world's best-selling and most profitable drugs.

Gastric ulcers have been considered typical psychosomatic disorders. Psychiatric thought from the 1930s attributed gastrointestinal disorders to intrapsychic conflicts often arising in highly motivated individuals frustrated by business world challenges. An alternative view that stress could cause physical illness arose primarily from the researches of Hans Selye on the body's physiological responses to "stress." He also argued that sources of stress could be psychological as well as physical. In dealing with this topic, we need to be clear about the key concepts. These include what we mean by *stress*, *psychosomatic*, and *disorder*.

*Stress.* Stress is discussed elsewhere in this encyclopedia in some detail. The definition of *stress* is not simple, but a reasonable working definition would be

chronic environmental strain and challenges, physiological and/or psychological, that threaten the organism's integrity.

*Psychosomatic.* The term *psychosomatic* implies an ancient mind-body "dualism" that is generally no longer accepted. We now know that our emotions and thoughts are emergent properties of brain function just as are other bodily processes. Nonetheless, the term psychosomatic persists as we try to distinguish the sources of the stress and when we wish to distinguish sources or processes that are clearly biophysical in origin from those that are psychological/emotional reactions to events, threats, or failures to cope with *either* the biophysical or psychological strain.

*Disorder.* Gastric problems range from indigestion to changes in gastric function (e.g., abnormal motility, increased acid production) to erosions in the stomach wall to lesions penetrating the stomach wall. Both erosions and lesions we shall call ulcers because they are on a continuum of severity. The disorder may include bacterial infection that exacerbates the erosions and may even cause stomach cancer. The issue of infection has become one of importance because recent medical practice has been to assume that all ulcers are the product of a bacterial infection (*Helicobacter pylori*) and hence a simple biophysical disease not involving causal or contributory psychological/emotional factors. Recently, this view has been undergoing revision toward one of ulcer being a stress-diathesis product, wherein stress interacts with other factors that may include genetics, bacteria, and lifestyle contributors such as smoking, alcohol use,

aspirin use, excessive exertion, irregular meals, and irregular sleep patterns.

Treatment for a disorder is often most effective if selectively targeted. To target a treatment, one may be aided by knowing the causal factors: physiological, psychological, or behavioral. Therefore, substantial research has been devoted to determining the causal variables and processes for gastric ulcers including the role, if any, for stress.

## BASIC PSYCHOLOGICAL SCIENCE AND THE STRESS-CAUSED ULCER ISSUE

We are all well aware of Ivan Pavlov's classic experiments on the conditioned reflex in which he used a metronome to signal impending food. We often overlook that he specifically demonstrated that components of the gut are sensitive to environmental relations that result in learning. Research since then has confirmed that most psychobiological and emotional responses are sensitive to the environmental relations that produce learning and come to occur as anticipatory responses. Stewart Wolf and Harold G. Wolff directly observed that a human patient's stomach responses are exquisitely sensitive to the individual's emotional state.

Psychological and medical sciences seek to understand complex health problems by developing animal models of the disorder because one can study their causes and therapies without risk to human patients. Animal models can explore the degree to which stress modulates a variety of factors that operate inside the stomach, such as acid and other secretions, and stomach contractions, and determine whether and how they contribute to the production of ulcers.

First efforts with animal models to explore the ulcerative process(es) were by physiologists following up on the strong physical challenges pioneered by Selye, such as total immobilization often combined with cold. Many factors were identified as participatory, but the actual local gut mechanisms for the induction of gastric erosions and ulcers were not fully understood because of the number of interacting processes involved. Although the causal chain was not fully described by these studies, the roles of the vagus nerve (the major nerve pathway between the brain and the gut, and vice versa) and histamine release in the stomach were established, leading to development of surgical interventions and modern medications.

Nonetheless, even with later more extensive knowledge about local mechanisms, the determinants

of who will get an ulcer and when were still not understood. These physiological models focused on biology, but Selye indicated that psychological factors, missing from these physiological studies, were likely contributors as well.

One focus of psychological studies was behavior. Activity is a factor for ulcer induction. It has long been known that systematically controlled temporal schedules of access to food induce a variety of behaviors, and such behaviors are directly correlated with stomach activity. Prolonged exposure to the combination of restricted access to food for 1 or 2 hours *once* each day results in spontaneous increases in running, the development of gastric ulcers after several days, and even death. These "activity stress" ulcers are not due per se to either restricted food or access to the running wheel, but to the combination of these factors and the dramatic increases in activity. The phenomenon is readily demonstrable in a variety of species, and interest in this ulcer model has been sustained by an analogy to anorexia nervosa, the self-starvation that afflicts many young women today.

Other early psychological models demonstrated that psychological factors related to coping with stress rather than physical/physiological factors were causal in ulcer induction. An early example of such a model Joseph Brady called the "executive monkey" experiments. Two monkeys were initially set to the task of learning to press a lever to avoid delivery of a brief, mild electric shock. The monkey that seemed to be learning the avoidance task faster was then designated the "executive" and, from that point on, only its responses controlled shock deliveries, although if the executive received a shock, they both did. Thus, the monkeys were equated for physical experiences (shocks) but they differed in their fear of shocks (the faster learner was designated the executive) and their avoidance behavior. The outcome of this arrangement was unexpected. After some weeks, the executive monkey died and autopsy revealed that it had massive ulcers in the stomach. These experiments have been criticized on a number of grounds. Yet they did make clear that animals with identical physical experiences with shock but with different psychological relations to the shock were differentially vulnerable to ulcers. That is, the ulcers were a psychosomatic disorder, a disorder in which psychological variables were powerful contributors. Although this paradigm proved not to be widely generalizable, it did stimulate others to seek to demonstrate in different animal models that

psychological factors play a role in the gastric ulcer process.

### NEWER STRESS-DIATHESIS APPROACHES

Newer approaches see ulcer as a product of several causal factors, including constitutional predisposition, and precipitated by a particular event or stressor. Several factors predisposing to gastric ulceration when an organism is stressed were noted above, but *how* these influence vulnerability is neither always obvious nor direct. For example, age at weaning is one critical factor. Rats weaned early are more vulnerable to ulcerations and this was initially attributed to social-psychological trauma. But detailed follow-up studies revealed the actual mechanisms to be early malnutrition resulting in later poorer thermoregulation when challenged with restraint and cooling.

Life is a continuing series of biological-developmental-experiential events all of which have their cumulative and interacting effects on the organism. With respect to virtually any disorder, the most sensible appreciation of complexity distinguishes three classes of causal factors: *predisposing*, *precipitating*, and *perpetuating*. Each of these types of causal factors may be physiological or psychological. We shall now consider some of the evidence for psychological contributions in each of these phases.

#### Predisposing

Rather than seeking a psychological manipulation that can be said to be directly causal of ulcer, Robert Murison and Bruce Overmier looked for psychological manipulations that modulate the organism's vulnerability to some separate ulcer-inducing event. The latter could be a stressor or even a bacterial infection. A series of researchers asked how past experiences and psychological variations in these can increase or decrease vulnerability to a stressor of known ulcerogenicity, in their case, restraint and partial immersion in water (RIW). This RIW method for reliably precipitating ulcers is to vertically suspend a fasted rat moderately restrained inside a tube in a bath of room temperature water. This "physical" ulcer-inducing challenge itself may well have psychological components to it because it is ulcerogenic only in conscious animals.

The protocol calls for exposing the animals to a first stressor and then at some later time exposing the

animals to the RIW challenge. The question asked is what features of the first stressor, if any, influence the relative vulnerability to the ulceration induced by the second challenge. The modulatory effects could be to either exacerbate or ameliorate the vulnerability to the directly induced gastric erosions.

For psychologically relevant variations, they turned first to the established knowledge of learned helplessness, a psychologically important stress-induction paradigm of relevance to humans, and then to classical conditioning and instrumental learning, core psychological strategies for coping with and adapting to environmental challenges. It is well established that prior coping experiences facilitate later learning while noncoping has later pathological consequences. Initial studies showed a dramatically increased vulnerability to ulcers following earlier exposure to uncontrollable and unpredictable stressful events such as electric shocks known to induce helplessness. Given that treatments that induce learned helplessness also increase vulnerability to gastric erosions, would treatments that prevent learned helplessness, like the ability to control the shocks, also modulate the increased ulcer vulnerability?

*Controllability.* There are several forms of control over shocks that might be relevant: control over shock onset, severity, or duration. One study compared three groups of rats that differed only in the initial shock treatment. There were control rats that received no shocks, escape rats that received shocks the onsets of which were unpredictable and uncontrollable but the durations of which were controlled by the rats pressing a lever to escape the shocks, and yoked rats that received shocks of exactly the same numbers and durations as did the escape rats but who themselves had no control. The yoked rats showed the greatest amount of erosions and 3 times more than the escape rats after later RIW. Thus, controllability of aversive events determines the long-term aftereffects of the experience as a modulator of vulnerability. In addition, the level of erosions in the control rats was intermediate between the levels seen in the escape rats and the yoked rats. This study confirmed the negative consequences of unpredictable, uncontrollable shocks, but the pattern also revealed a new effect. This is that prior coping experience *reduces* vulnerability to later challenges, a kind of "learned mastery" effect, opposite of learned helplessness.

*Predictability.* In the helplessness literature, most attention has been given to the importance of escape, but learned helplessness has multiple symptoms that may have different experiential causes. In particular, lack of predictability has been shown to interfere with subsequent associative learning just as lack of controllability interferes with subsequent instrumental learning. There are several forms of predictability of shocks: of shock onsets, of shock severity, of the end of the shocks, and prediction of the period of safety between shocks; the effects of these may differ. What might one expect as a result of signaling shocks? One possibility is that it reduces the surprise and hence reduces the aversiveness of each shock; alternatively, the warning could elicit anxiety and increase the total stress experience, with consequences for increased vulnerability to later ulcerogenesis.

One experiment included a test of whether signaling of shock onsets by a conditioned stimulus (CS) during exposure to uncontrollable shocks would modulate their exacerbatory influence. Three groups were compared: rats that experienced no shocks prior to the RIW challenge, rats that experienced unpredictable shocks (that were also uncontrollable), and rats that had the same shocks but each was preceded by a warning signal. Although prior exposures to shocks proactively increased vulnerability to the ulcerogenic challenge as expected, signaled shocks did so to a substantially lesser degree. Signaling the uncontrollable shocks reduced vulnerability relative to the effect of unsigned shocks.

A second form of predictability is provided by a stimulus that immediately follows each shock. This paradigm is called backward conditioning and it allows prediction of the safe period that typically follows each shock. It also coincides with the "relief" that follows pain, and is known to classically condition an "opponent process" that is the opposite of that conditioned by signals for shock onsets. The influence of this second form of signaling has also been assessed. Three groups of rats differed in their treatments before the water challenge: one group received no shocks, another received a series of shocks and an equal number of tones that occurred randomly in time, and the third group received the same series of shocks each one followed immediately by the tone backward CS. The rats that had had the backward CS showed only one fourth as much gastric erosion in response to later RIW challenge as did the rats that had not had this backward CS. That is, signals at the end of shocks

appear to be functionally equivalent to a controlling response that terminates shocks in terms of reducing the increase in ulcer vulnerability.

### Precipitating

An early study by Martin Seligman linked the learned helplessness paradigm to ulcer, a symptom that is elevated in depressed patients. Unlike the proactive studies described above, here the ulcer-precipitating stress was shock itself. Rats exposed on each of several days to the learned helplessness treatment of uncontrollable and unpredictable shocks showed greater gastric ulceration than those that received predictable, uncontrollable shocks. This particular experiment, however, was seriously confounded by differences in food consumption between the two groups, with the rats in the helplessness condition eating substantially less, and it is known that self-starvation can result in gastric erosions. Nonetheless, the helplessness experiments stimulated new interest in controllability and predictability of aversive events as important modulating factors.

An excellent set of studies by Jay Weiss on the importance of controllability and predictability as modulators of stress in the production of ulcers studied independently and interactively the psychological factors of prediction and control concurrently. Triplets of animals were studied with (1) one "master" trained on a temporally paced escape/avoidance task, (2) one having ineffective responses but receiving in "yoked" fashion all the events that the master received, and (3) one with ineffective responses that also never received shocks. There were two types of triplets: for one, all shocks were predictable, whereas for the other, no shocks were predictable. After 48 hours under these conditions, gastric ulceration was reduced by prediction and by control and these were additive. The importance of control is independent of the particular coping response, although the reliability and precision of control are important as is feedback that the correct response has been performed.

Taken together, these studies show that when behavioral treatments that support instrumental or classical forms of learning are a concurrent part of a stress situation, these psychological variations are important modulators of the degree of stress-induced ulceration. Intriguingly, behavioral opportunities to act-out aggressively concurrent with the shock stress have also been shown to ameliorate the degree of

ulceration. The opportunity to attack a conspecific or engage in other natural defensive coping behaviors when under threat and/or experiencing pain reduces the gastric ulcer consequences of aversive experiences.

An alternative approach emphasized that *conflict* was a powerful source of psychological stress that might be directly ulcerogenic. A series of experiments was carried out in which rats were placed in an approach-avoidance conflict situation. A typical arrangement was for the animal to first learn to earn its food and water, and then an additional contingency was imposed such that seeking food *also* resulted in the delivery of a brief, mild electric shock. Thus, the animal was believed to suffer the clash of incompatible motivational states and, indeed, rats exposed to such conflict for 30 days showed more ulcers than those merely deprived of food. Later experiments with better controls confirmed the result and established that the shocks per se were not ulcerogenic. However, other experiments directly challenge conflict as the cause of ulcers. William Paré compared water-deprived rats subject to daily conflict in which they had to accept shocks to obtain water with yoked rats that received matched amounts and distributions of shocks and water. Importantly, because these rats were not chronically food deprived, we can infer that any ulcers observed were predominantly glandular. The result was that the control rats developed more ulcers than did the rats experiencing conflict.

In overview, those studies testing the ulcerogenicity of conflict have not convincingly demonstrated it to be a causal factor in ulcerogenesis. Rather, they seem to have identified exposure to the stress of aversive stimulation that suppressed food intake as the central causal factor.

Several different methods have been tried to induce gastric ulcerations in a search for a purely *psychological* cause. These studies have each presented to the organism some challenge that had physical threat components accompanied by an associated behavioral/psychological component. The combination of these resulted in amounts of ulceration not fully accounted for in terms of the physical treatment alone. Thus, these studies have shown some psychological and cognitive factors to be important, particularly control and predictability of aversive events, and these act to ameliorate ulcerations. None of the reviewed studies have found evidence for a purely psychological cause of ulcerations.

## Perpetuating

Do manipulations after an ulcerogenic stress have significant effects on perpetuation of ulcer? The question is whether during a *post*-gastric ulceration “rest” period includes signals for danger. Murison and Overmier demonstrated that psychological treatments after ulcer induction could influence the sustaining process; their work involved a comparison of three groups. One group experienced only a series of neutral CSs prior to the later RIW challenge; the other two groups received the same CSs each paired with shock days prior to the ulcer-inducing water challenge. Then, *after* RIW, all groups were “rested” for 2 hours, during which the unshocked group and one of the shocked groups received intermittent presentations of the CSs (but without shocks). It was expected that re-presentation of CSs that had earlier been paired with shock would represent a threat to the rat and might perpetuate the ulcerative process. Exactly that was observed. The preshocked group that during rest had re-presentations of the warning CS showed dramatically more gastric ulcers. Thus, the perpetuating process can be modulated by psychological manipulations.

Consistent with a stress-diathesis model, the above experiments have confirmed that the ulceration processes can be modulated by psychological treatments in all three of the ulcerative stages, predisposing, precipitating, and perpetuating. It would be of interest to know the local gut mechanisms through which these psychological processes effect their modulation, but lack of such knowledge does not invalidate the facts.

## BACTERIA AS A DIATHESIS FACTOR

The series of studies reviewed confirms that psychological factors modulate gastric erosions in animal models, and because we know that emotional states influence the human stomach, it is reasonable to believe that such psychological factors relating to stress operate in humans as well. This implies that gastric ulcer is a “psychosomatic” disease in the sense that psychological states modulate vulnerability. However, the view of ulcerogenesis changed with Marshall’s discovery of *Helicobacter pylori* (Hp), a bacterium that infects substantial numbers. Physicians have noted that the conditional probability of infection in ulcer-presenting patients is 70% to 95% (depending on whether it is gastric or duodenal) and

that treatment of this infection eliminates the ulcer in about 80% of patients. So it is not surprising for it to be believed that Hp causes ulcers and that the clinical medical problem is solved.

The reason for a challenge to the medical hypothesis of Hp as the unique cause is that up to 60% to 80% of asymptomatic controls (depending on age) show Hp infection. Thus, while a high percentage of patients presenting with ulcer do have a bacterial infection, the inverse conditional probability of having an ulcer given that one has an Hp infection is less than 20%. In addition, another 20% of stomach ulcer patients are uninfected. Thus, Hp infection alone is an insufficient account of gastric ulcer. Unanswered are why some infected persons do not show ulcers and what it is that results in ulcers in infected persons. The answer is the classic "stress  $\times$  diathesis" interaction model in which at least one part of the diathesis is Hp infection.

Hp infection rate and cumulative life stresses are both correlated with age. In addition, Hp infection is associated with low socioeconomic status, and persons in low socioeconomic status have less control over their lives, especially in the workplace. They are also subject to greater economic stress and face more social barriers. Such persons, especially as they get older and apparent opportunities fade, are more likely to report depression, helplessness, and hopelessness. Life becomes uncontrollable and unpredictable, the very psychological factors that are important in modulation of ulcer vulnerability in animal research. This convergence of data from animal models and the epidemiological literatures suggests that at last we are beginning to understand the causes of gastric ulceration.

#### FUTURE RESEARCHES ON GASTRIC ULCER

Something is modulating vulnerability to Hp associated ulcer. Among these, Susan Levenstein has identified past life challenges as important risk factors, as well as a number of other social and behavioral factors. Thus, any future research strategy for animal models that seeks to link past research programs to human disease must study the interaction of (a) psychological modulators of the types that research has validated as relevant, (b) immunologic status and bacterial exposure, and (c) current physical or psychological stress. There also exist parallels between the psychologically relevant operations that modulate

gastric vulnerability and those that modulate immune status. This last relation is made more significant by recent findings that local target actions of some new potential antiulcer drugs may be the immune system. Such psycho-immuno-ulceration experiments may be seen as a potential final hurdle in our understanding of gastric ulcers.

Whatever the outcome of these researches, it is clear that the causes of ulcer are complex and hence that the optimal treatments involve more than antibiotics, and must involve additional efforts to address the individual's sources of stress and coping inefficiencies as well as lifestyle and socioeconomic interventions. Gastric ulcer is the epitome of a socio-psychological-biomedical dysfunction.

—J. Bruce Overmier and Robert Murison

See also ALLOSTASIS, ALLOSTATIC LOAD, AND STRESS; PEPTIC ULCERS AND STRESS; STRESS, APPRAISAL, AND COPING; STRESS: BIOLOGICAL ASPECTS

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## GATE CONTROL THEORY OF PAIN

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The specificity theory of pain that we inherited in the 20th century derives from a concept of the nervous system proposed by René Descartes three centuries earlier. Specificity theory maintains that injury activates specific pain receptors and fibers, which, in turn, project pain signals through a spinal pain pathway to a pain center in the brain. The psychological experience of pain, therefore, is virtually equated with peripheral injury. In the 1950s, there was no room for psychological contributions to pain, such as attention, past experience, and the meaning of the situation. Instead, pain experience was held to be proportional to peripheral injury or pathology. Patients who suffered chronic pain syndromes without presenting signs of organic disease were labeled “crocks” and sent to psychiatrists. The picture, in short, was simple. However, to thoughtful clinical observers, it was clearly wrong (Livingston, 1943; Noordenbos, 1959).

In 1965, Melzack and Wall proposed the gate control theory of pain, based on the following propositions:

1. The transmission of nerve impulses from afferent fibers to spinal cord transmission cells is modulated by a spinal gating mechanism in the dorsal horn.
2. The spinal gating mechanism is influenced by the relative amount of activity in large-diameter and small-diameter fibers: Activity in large fibers tends to inhibit transmission (close the gate), while small-fiber activity tends to facilitate (open the gate).
3. A specialized system of large-diameter, rapidly conducting fibers (the *central control trigger*) activates selective cognitive processes that then influence, by way of descending fibers, the modulating properties of the spinal gating mechanism.
4. When the output of the spinal cord transmission cells exceeds a critical level, it activates the *action system*—those neural areas that underlie the complex, sequential patterns of behavior and experience characteristic of pain.

When the gate control theory was published, it generated vigorous debate as well as a great deal of research to disprove or support the theory. By the mid-1970s, the theory was presented in almost every major textbook in the biological and medical sciences. At the same time, there was an explosion in research on the physiology and pharmacology of the dorsal horns and the descending control systems.

The theory's emphasis on the modulation of inputs in the spinal dorsal horns and the dynamic role of the brain in pain processes had a clinical as well as a scientific impact. Psychological factors, which were previously dismissed as “reactions to pain,” were now seen to be an integral part of pain processing, and new avenues for pain control were opened. Similarly, neurosurgical procedures such as cutting nerves and spinal pathways have been gradually replaced by a host of methods to modulate the input. Physical therapists and other health care professionals who use a multitude of modulation techniques were brought into the picture. The current status of pain research and therapy has recently been evaluated (Melzack & Wall, 1996) and indicates that, despite the addition of a massive amount of detail, the theory remains basically intact.

The gate control theory's most important contribution to pain research and therapy is its emphasis on the central rather than the peripheral nervous system (Melzack, 1998, 1999; Melzack & Wall, 1996). Knowledge of spinal mechanisms has advanced enormously (Wall & Melzack 1999), and the great challenge at present is to understand brain mechanisms. Melzack and Casey (1968) made a start by proposing that specialized systems are involved in the sensory-discriminative, motivational-affective, and cognitive-evaluative dimensions of pain. So too, the McGill Pain Questionnaire, which taps into subjective experience generated by the brain, was developed and is widely used to measure pain (Melzack, 1975, 1987).

The gate control theory also postulated that the brain exerts a tonic inhibitory effect on pain, which led directly to the discovery by Reynolds (1969) that electrical stimulation of the midbrain periaqueductal gray (PAG) area produces analgesia. Subsequent research (Liebeskind & Paul, 1977) revealed that the PAG contains pharmacological substances such as endorphins that contribute to the descending inhibition. Later, a series of definitive studies on “diffuse noxious inhibitory controls” (DNIC) firmly established the power of the brain in controlling spinal



transmission (Fields & Basbaum, 1999; Le Bars, Dickenson, & Besson, 1983).

In 1978, Melzack and Loeser described severe pains in the phantom body of paraplegics with verified total sections of the spinal cord, and proposed a central “pattern generating mechanism” above the level of the section. This concept represents a major advance: It does not merely extend the gate; it proposes that pain can be generated by brain mechanisms in paraplegics in the absence of sensory input from the body area that is perceived as painful.

It is evident that the gate control theory has taken us a long way. Yet, as historians of science have pointed out, good theories are instrumental in producing facts that eventually require a new theory to incorporate them. It is possible to make adjustments to the gate theory so that it includes postinjury expansion of peripheral receptive fields and long-lasting neural activity (see Melzack & Wall, 1996). But there is a set of observations on pain in paraplegics that does not fit the theory. This does not negate the gate theory, but rather incorporates it into a broader conceptual system. Peripheral and spinal processes are obviously an important part of pain and we need to know more about the mechanisms of peripheral inflammation and spinal modulation. But the data on painful phantoms below the level of total spinal section (Melzack, 1989, 1990) indicate that we need to go above the spinal cord and into the brain.

The brain areas related to pain involve more than the spinal projection areas in the thalamus and cortex. These areas are important, of course, but they are only part of the neural processes that underlie perception, emotion, and cognition, which are all part of pain experience and behavior. The cortex, Gybels and Tasker (1999) have made amply clear, is not the pain center and neither is the thalamus. The areas of the brain involved in pain experience and behavior must include these somatosensory projections and, in addition, must also include the limbic system as well as widespread areas of the brain known to be involved in cognitive processes.

An analysis of phantom limb phenomena, particularly the astonishing reports of a phantom body and severe phantom limb pain in people after a cordec-tomy—that is, complete surgical removal of several spinal cord segments—led to four conclusions that point to a new conceptual nervous system (Melzack, 1989, 1990). First, because the phantom limb (or other body part) feels so real, it is reasonable to

conclude that the body we normally feel is subserved by the same neural processes in the brain; these brain processes are normally activated and modulated by inputs from the body but they can act in the absence of any inputs. Second, all the qualities we normally feel from the body, including pain, are also felt in the absence of inputs from the body; from this we may conclude that the origins of the patterns that underlie the qualities of experience lie in neural networks (or *neuromatrixes*) in the brain. Stimuli may trigger the patterns but do not produce them. Third, the body is perceived as a unity and is identified as the “self,” distinct from other people and the surrounding world. The experience of a unity of such diverse feelings, including the self as the point of orientation in the surrounding environment, is produced by central neural processes and cannot derive from the peripheral nervous system or spinal cord. Fourth, the brain processes that underlie the body-self are “built-in” by genetic specification, although this built-in substrate must, of course, be modified by experience. These conclusions are the basis of the neuromatrix theory of pain—the most recent conceptual model that has evolved from the gate control theory (Melzack 1989, 1990, 2001).

The neuromatrix theory of pain proposes that the anatomical substrate of the body-self is a large, widespread network of neuron loops between the thalamus and cortex as well as between the cortex and limbic system. Melzack has labeled the entire network, whose spatial distribution and synaptic links are initially determined genetically and are later sculpted by sensory inputs, as a neuromatrix. The loops diverge to permit parallel processing in different components of the neuromatrix and converge repeatedly to permit interactions between the output products of processing. The repeated *cyclical processing and synthesis* of nerve impulses through the neuromatrix imparts a characteristic pattern: the *neurosignature*. The neurosignature of the neuromatrix is imparted on all nerve impulse patterns that flow through it; the neurosignature is produced by the patterns of synaptic connections in the entire neuromatrix. All inputs from the body undergo cyclical processing and synthesis so that characteristic patterns are impressed on them in the neuromatrix. Portions of the neuromatrix are specialized to process information related to major sensory events (such as injury, temperature change, and stimulation of erogenous tissue) and may be labeled as neuromodules that impress subsignatures

on the larger neurosignature. The neurosignature, by means of mechanisms that remain a challenge to research, converts the stream of nerve impulses (the neurosignature modulated by ongoing inputs) into a continually changing stream of awareness.

The body is felt as a unity, with different qualities at different times. Melzack proposes that the brain mechanism that underlies the experience comprises a unified system that acts as a whole and produces a neurosignature pattern of a whole body. The conceptualization of this unified brain mechanism lies at the heart of the neuromatrix theory. Melzack visualizes a genetically built-in neuromatrix for the whole body, producing a characteristic neurosignature for the body that carries with it patterns for the myriad qualities we feel. The neuromatrix produces a continuous message that represents the whole body in which details are differentiated within the whole as inputs come into it. We start from the top, with the experience of a unity of the body, and look for differentiation of detail within the whole. The neuromatrix, then, is a template of the whole, which provides the characteristic neural pattern for the whole body (the body's neurosignature) as well as subsets of signature patterns (from neuromodules) that relate to events at (or in) different parts of the body.

The experience of the body-self involves multiple dimensions. The sensory dimension is subserved, in part at least, by portions of the neuromatrix that lie in the sensory projection areas of the brain; the affective dimension is subserved by areas in the brainstem and limbic system; the cognitive dimension is determined by the frontal, parietal, and other cortical areas. Each major psychological dimension (or quality) of experience is subserved by a particular portion of the neuromatrix that contributes a distinct part of the total neurosignature. To use a musical analogy, it is like the strings, woodwinds, and brasses of a symphony orchestra that each comprise a part of the whole; each makes its unique contribution yet is an integral part of a single symphony, which varies continually from beginning to end.

The output of the body-self neuromatrix, Melzack (1991, 2001) proposes, is directed at two systems: (1) the neural system that produces awareness of the output and (2) a neuromatrix that generates overt action patterns. In this discussion, it is important to keep in mind that just as there is a steady stream of awareness, there is also a steady output of behaviour.

It is important to recognize that behavior occurs only after the input has been at least partially synthesized and recognized. For example, when we respond

to the experience of pain or itch, it is evident that the experience has been synthesized by the body-self neuromatrix (or relevant neuromodules) sufficiently for the neuromatrix to have imparted the neurosignature patterns that underlie the quality of experience, affect, and meaning. Apart from a few reflexes (such as withdrawal of a limb, eye-blink, etc.), behavior occurs only after inputs have been analyzed and synthesized sufficiently to produce meaningful experience. When we reach for an apple, the visual input has clearly been synthesized by a neuromatrix so that it has 3-dimensional shape, color, and meaning as an edible, desirable object, all of which are produced by the brain and are not in the object "out there." When we respond to pain (by withdrawal or even by telephoning for an ambulance), we respond to an experience that has sensory qualities, affect, and meaning as a dangerous (or potentially dangerous) event to the body.

—Ronald Melzack

See also PAIN: PSYCHOSOCIAL ASPECTS

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## GENDER DIFFERENCES IN HEALTH

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Differences between men and women in relation to their social lives, activities, roles, behaviors, and longevity have existed for centuries. Until recently, these differences have almost been taken for granted and largely ignored. Increased research concerning health inequalities and inequities based on socioeconomic position seems to have contributed to the growing interest in gender inequities in health. It has thus become inevitable to address health inequalities and inequities based on gender, as it is a major component of social construct besides socioeconomic position

and race or ethnicity. Even the World Bank has acknowledged that economic development in the low-developed economies cannot be enhanced without addressing issues of gender equity.

This entry highlights gender inequity in health, by defining and analyzing differentials in men and women not only in relation to morbidity, mortality, and health care access and utilization but also the determinants of gender disparities in health that operate at both macro and micro levels.

## GENDER DIFFERENCES IN MORBIDITY

According to the World Health Organization (WHO), morbidity is measured as the incidence or prevalence of the presence of illness or injury. Health surveys and statistics consistently demonstrate that women have higher morbidities of a wide range of health indicators than men, including physical illness, disability days, physician visits, and drug use. Men have higher rates of more serious chronic diseases and long-term disability due to chronic conditions leading to death. Injury rates are higher among younger men, but among the elderly, women have higher rates, particularly for mortality.

There are a number of explanations for high morbidity in women and high mortality in men. In a review of literature, Verbrugge (1989) identified short- and long-term morbidities and noted that in the short run women are more frequently sick, with higher rates of daily symptoms and higher incidence rates of acute illness. In the long-run women have higher rates of numerous nonfatal chronic conditions that lead to abundant symptoms, disabilities, and medical care, but not to death. Men's higher mortality is thus linked to higher rates of life-threatening chronic conditions, such as ischemic heart disease.

Generally, there are varying biological susceptibilities to disease that expose men and women to different morbidities. For example, women's unique reproductive health exposes them to specific morbidity risks that are not present in men. On the other hand, women have genetic resistance to diseases such as those related to X-chromosomes. Women's sex hormones protect them from cardiovascular morbidity until menopause, whereas men lack such protection and are thus more susceptible to cardiovascular morbidity 10 years earlier than women. The seemingly more advantageous biological protection for women's mortality, however, does not fully explain why women

have higher morbidity rates, ranging from short-term to long-term disabilities, including acute conditions, chronic diseases, headaches, and musculoskeletal diseases. Thus, other factors besides biology, such as social, behavioral, and cultural factors, are important determinants of well-being and should not be ignored.

Sharp gender differences are observed in psychiatric and psychological disorders, where women have increased burden of such disorders. Depression warrants special attention in this respect. Statistically, women are overrepresented in the prevalence of depression in many countries. Depression is a serious health disorder that predicts life-threatening health outcomes such as coronary heart disease (CHD). Depression has also been identified by the WHO global burden disease study as the fourth largest global health problem, which is predicted to rank second in 20 years time, that is, following cardiovascular disease.

As Macintyre and Hunt (1997) stated, gender differences in health are not as simple. They are conceptual and methodological problems, particularly concerning interactions of gender with other social factors that should be considered. Self-rated health, for example, which is universally used to estimate health or illness, may not be the most suitable indicator for addressing gender differences in health. Health or illness may mean different things for men and women, as they may differentially perceive and evaluate symptoms, along with other influences, such as social context, cultures, or traditions. Methodologically, statistics from the health surveys on morbidity are often based on health problems that prevent people from doing their regular major activities and need for medical care. Health problems that are acted on by nonmedical health professionals and other self-care activities are not well captured in health statistics, and thus do not provide the clear picture of health problems that influence men's and women's daily lives.

## GENDER DIFFERENCES IN MORTALITY

Life expectancies in men and women differ from country to country and are dependent on overall national economic development, specific aspects of gender inequities within those countries, and the relevant health problems. For example, in sub-Saharan Africa where HIV/AIDS is the major cause of death, a higher mortality is obvious in women than in men.

In Western societies where cardiovascular disease is the major cause of death, a higher mortality is observed in men than in women.

Another major explanation is that related to alcohol consumption. For example, the increasing male-female gaps in mortality rates in Russia may largely be attributed to high alcohol consumption among men. In Sweden, the male-female gaps in mortality narrowed from the 1980s, which paralleled decreased alcohol consumption, particularly among men.

Lawlor, Ebrahim, and Davey-Smith (2001) observed that while some of the differences in men's and women's life expectancy certainly reflect biological influences, it is clear that biology alone is an incomplete explanation. Social conditions affect women's health beyond biological differences. The biological protection against early death, whereby women have higher life expectancy than men, is not uniform in all countries and not defined in various socioeconomic positions. According to the *WHO Health Report* (World Health Organization, 1999), poor women have lower life expectancy than poor men. In societies where women's social status is very low, in addition to lack of resources for education of girls and lack of investment in women's health care, women are more likely to have poor nutrition, less access to health care, lower economic autonomy, shorter spacing and a larger number of births, poor maternal health care, and higher maternal and infant mortality. Therefore, gender differences in health may be better understood by analyzing the social, cultural, and structural dimensions of gender relations including investigating the nature of social systems, men's and women's structural place, and the roles they play within those systems.

## GENDER DIFFERENCES IN HEALTH CARE ACCESS AND UTILIZATION

Generally, women have been reported to visit health care professionals more frequently and to consume more pharmaceutical drugs than men. Women value health and more often seek care in the initial stages of a health disorder, and they are more willing to take actions for their symptoms than men. In spite of this phenomenon, studies in the United States, the United Kingdom, and Sweden indicate that complicated or specialist-based diagnostic and therapeutic procedures are less often applied to women than to men. An evaluation of behaviors among health care

professionals in 45 different primary care centers in the United Kingdom in 2001 demonstrated that screening and treatment of cardiovascular risk factors were less often done for women than for men, including less complicated registrations of smoking status, family history, height, weight, and blood pressure.

Even in Sweden where health care is publicly financed by the tax revenues, gender inequities in rehabilitation programs have been observed over a long period of time. Today, over 60% of the individuals who are on long-term sick leave are women. In spite of this, official statistics show that men's rehabilitation cost is about 4 times more than that given to women and that women are more likely to receive a much shorter and less aggressive rehabilitation than men.

On the contrary, women in less developed societies less frequently visit health care professionals, further contributing to late and inappropriate medical care. There are various explanations for this, such as poor infrastructure, lack of economic resources, longer distance between home and health center, refusal of the husband's permission, or knowledge deficiency due to low education.

An attempt toward broader understanding of gender differences in health can be found in Wamala and Lynch's (2002) volume that integrates gender with socioeconomic position, culture, and ethnicity. They demonstrated that an evaluation of how men and women access or possess health-promoting and protective resources, encounter health-damaging exposures, and develop susceptibilities to physiological exposures is of great importance. Such an approach may provide a broader understanding of gender differences in health, other than just focusing on the statistical differences in rates of morbidity and mortality and how health care is utilized. As Sen (1995) suggested, gender differences in health should be regarded in terms of both inequalities (the measurable) and inequities (the moral judgment).

## MACRO-LEVEL ASPECTS OF GENDER DIFFERENCES IN HEALTH

### Gender Construction and Stratification

In spite of the fact that gender and sex mean different things, the two terms have often been used interchangeably to mean the same thing. Even in various scientific reports, *gender* has been used to replace *sex* particularly in statistical tables.

Sex refers to the biological differences: genetic, anatomical, and physiological differences that indicate whether one is a female or male and their implications on health susceptibilities or immunities. Gender, on the other hand is a social construct, associated with how males and females are organized in the society and the associations with power relations, behaviors, and roles that place them at an advantage or disadvantage over access and control of (health promoting) resources.

The association between gender and health can also be better understood by addressing the key characteristics of gender, which include gender roles, access to and control of resources, contextual aspects, and structural issues. It should be noted, however, that gender as a concept is not static—it is as dynamic as society. The roles and relations between men and women in a given society, therefore, vary from one generation to another, and change as the social norms and values change in a given society. Also, gender characteristics may be modified by interventions toward gender equity.

### Gender Roles

Gender roles refer to the different social roles that men and women play. The relationships between men and women are socially constructed and defined by these roles. Although these roles can be gender specific, they are culturally defined and learned throughout the life course. There are no universal roles specific to men or women; these roles vary with different cultures, because of different levels of economic growth and differing traditions, expectations, psychological processes, and behaviors. However, in almost all cultures women have greater responsibility for not only domestic activities (such as child care, household tasks) but also wage-earning activities and heading the family. The recent developments in gender roles where men in many societies have surrendered their traditional role of wage earner and being the head of the family are disturbing. Many women today are faced with a wide range of roles including wage earning, domestic tasks, parenting and raising children single handed, and care of old and sick relatives.

There has been a transition from the traditional sex-role ideologies that men are more important than women and that they should dominate and control women to modern ideologies that emphasize equality

between men and women. The modern ideologies have been more successful in Western societies where there are high levels of democracy, with the exception of a few, such as Japan.

Women's participation in the labor force has been a major contribution to the modern ideologies of gender equality. In some societies, however, women's participation in the labor force by itself has not changed the traditional sex-role attitudes. A cross-cultural comparative study by Atsuko Suzuki showed that working North American women regardless of occupational status had more equality than nonworking women. In Japan, however, attitudes toward gender equality demanded more than just being employed—those with professional jobs were more egalitarian than others. Studies in egalitarian Sweden show that partners of women who hold career-oriented professional jobs are more likely to share domestic work than partners of women who hold less career-oriented or low-status jobs. Women's occupational status provides them with bargaining power not only at home but also in the society, and it is thus an important contributing factor to gender equality.

Feldman (2001) further suggested that gender roles and their impact on health can be better understood by evaluating not only the "quantity" but also the "quality" of these roles.

Macroeconomic forces, including distribution of power that influences division of domestic tasks and labor segregation that forces women into lower-status jobs, substantially influence the type of roles that men and women play in society.

### **Gender Differences in Access to and Control of Resources**

The differences between men and women are not neutral, which creates a hierarchical phenomenon. The pattern of access to and control of resources is an important determinant of how different hierarchical positions of men and women in society are created and maintained. The *Human Development Reports* of the United Nations Development Programme (UNDP) indicate huge global gender inequalities in social indicators (such as education, poverty, credit, and employment opportunities) that influence population health. For example, data from the UNDP indicate that 25% of families globally are headed by women. Yet 60% of the world's illiterate are women and earn only 10% of

the world's income, which is not surprising given that 70% of the world's poor are women.

There are several examples of how women's position in society is valued. For example, in Sweden where gender equality is among the best developed in the world, women earn 10% to 20% less than men at the same occupational level and with the same level of educational attainment. This pattern has remained unchanged for the past 20 years. Women's incomes are less than men in all socioeconomic groups. Women's short-term and low-paid employment are reflected by their socioeconomic disadvantage and economic instability, which further decreases their power to influence decisions, such as resource allocation and investment decisions, even within their own households. This is especially important for public health, as so many children are solely dependent on women. There are different economic implications of separation or divorce for men and women. Generally, women's income decreases after separation, while men's income increases. The negative consequences of socioeconomic disadvantage are detrimental not only to women's health but also to their children and may influence the entire lifecycle and create a vicious cycle of poverty.

Power can be analyzed in relation to knowledge, economic resources, decisions, and exploitation and operates at both interindividual and institutional levels. Even in democratic societies today, women still suffer negative effects of patriarchal and male-dominated society. Men's values still determine the norms of both public health policies and general medical practice. The persistently small number of women in national scientific academies even in highly democratic societies such as those in Western Europe and North America could be a reflection of unequal distribution of power in relation to knowledge.

The domestic power imbalance contributes to how gender roles are valued and ultimately affects gender inequity in society. Household income, for example, is not usually equally distributed, mainly because men often have higher incomes than women and thus greater control of the household income. Power imbalance may be misused, and may result in domestic violence.

Violence varies between men and women. While men's violence is often self-inflicted, violence-related injuries in women are often inflicted on them by others, often a male relative, mostly a partner.

### Contextual Aspects of Gender

Gender roles and relationships vary with cultural concept, birth cohort, and the ethnic and socioeconomic groups to which men and women belong. Thus, characteristics that are specific to a particular group of men or women should not be generalized to all men or women in different ethnicities, socioeconomic positions, or age groups.

Globalization processes that have resulted in increased migrations into Western countries demand broader knowledge of not only the gendered economy but also gendered culture within multicultural societies. Multiculturalism has led to the construction of “the other” woman. Women with other ethnic backgrounds that differ from those of “White” women have often been regarded as invisible and actually seen as a problem for feminists, particularly in Scandinavian countries. Gender order, particularly in White-dominated societies such as those of Scandinavia, has been mainly based on the norms of White men and women, ignoring the aspects of other ethnicities. Thus, gender should incorporate other domains of social construct, that is, socioeconomic position and ethnicity/race.

### Structural Issues Concerning Gender

Gender refers not only to interpersonal relations between men and women but also to the structural relations at a societal level that create and support the type of career choices and professions that men and women take on, gender values and beliefs that influence the type of health care and services that men and women receive, and their involvement in politics, business, and science.

The most obvious institutionally structured relation between men and women is observed in the labor market. Labor segregation in the labor market is apparent in many countries over the world. Labor segregation consists of both vertical<sup>1</sup> segregation and horizontal<sup>2</sup> segregation.

Female-dominated jobs are usually of lower status, characterized by higher demand, lower control and autonomy, and lower income, whereas male-dominated jobs are often of higher status, characterized by higher autonomy, higher control, and higher income and more favorable benefits. Due to labor segregation, men and women are exposed to varying health-damaging or health-promoting factors. For example, men

are more likely to be exposed to physical hazards (such as noise, vibrations, heavy lifting), whereas women are more likely to be exposed to psychosocial-related hazards (such as lack of control, high mental demand, lack of influence, lack of career possibilities).

### Policy Approaches to Gender Equity in Health

Gender equity refers to fair and just distribution of benefits and responsibilities between men and women, by recognizing the fact that men and women have different needs, access, and power.

Steps to successful policy approaches include analyzing gender roles, evaluating access to and control of resources that are vital for health-promoting purposes, and analyzing men’s and women’s needs in relation to their health. There are potential structural, legal, political, economic, and ideological processes that lead to gender differences in health that can be intervened upon.

## MICRO-LEVEL ASPECTS OF GENDER DIFFERENCES IN HEALTH

### Gender Differences in Behaviors

There is a range of differences in behaviors in men and women that may explain gender differences in health. For example, choices for leisure activities differ in men and women; men choose more aggressive and injury-related hobbies and sports than women do. Women’s and men’s social roles influence their behaviors toward children and other relatives; it is plausible that women’s high risk of flu and colds could be attributed to their more frequent contact with children and older people than men have. Men have more reckless health habits such as smoking and driving when drunk, which contribute to their higher prevalence of lung cancer and traffic accidents, respectively. Women’s multiple roles make them more vulnerable to psychological distress of anxiety and depression and guilt feelings and may contribute to their physiological reactions that differ from those of men.

Gender stereotyping of behaviors has been based mainly on biological differences in androgens (sex hormones that are produced in males in greater amounts than in females). Masculine and feminine behaviors have been attributed to the magnitude of exposure of androgens during critical periods of the

fetal stage. Udry, Morris, and Kovenock (1995) demonstrated that androgens are biologically programmed from fetal stage—meaning that individuals whose testosterone levels were high during the fetal stage remain high even in adulthood. Behavior is thus said to be biologically programmed and that it may not alter.

The theories about androgens and stereotyped feminine or masculine behaviors appear to be unrealistic and have often been criticized. This is because there are few men and women who possess all the characteristics that are stereotypically masculine or feminine, respectively. Gender stereotyping is complicated and misleading as the stereotyping does not seem to apply to older persons, minorities, or disabled persons.

In addition, scholars of stress demonstrate that the direction of association between behavior and androgens is not so simple. Lundberg and Frankenhaeuser (1999), in a study of physiological reactions to stress, showed high levels of stress to influence androgen levels negatively. Kemper (1990) went further and speculated that increased divorce rates in the United States can be attributed to women's aggressive and assertive behavior that results from increased female testosterone levels as a reaction to women's multiple roles of participation in the labor force and the traditional role of child and family care. Lindsey (1997) noted that there is an interaction between hormones and environmental factors that ultimately affects behaviors of males and females. The social structure and environment that individuals live in may therefore have a substantial impact on their behavior and ultimate physiological reactions.

### **Gender Differences in Social Networks and Support**

Humans become humans because of other humans; this African proverb seems to fit well in many other societies and for both men and women. Facing daily life stresses or happiness alone and not being able to share these with others have been linked with poorer outcomes. Generally, women are known to be the source of social support and to be better candidates than men in creating and maintaining social networks and contacts.

As Unden and Orth-Gomér (1989) recognized, the presence of a network does not mean that it is supportive or appreciated. Thus, it is important to distinguish

various dimensions of social networks and how they influence health in men and women. Henderson, Duncan-Jones, Byrne, and Scott (1980) identified two distinguished dimensions of social support: attachment (emotional support<sup>3</sup>) and social integration (relationships to friends, neighbors, work associates, and acquaintances). Cohen, Mermelstein, Kamarck, and Hoberman (1985) further broke social integration into various functions: belongingness,<sup>4</sup> tangible support,<sup>5</sup> and appraisal support.<sup>6</sup>

Women as compared to men usually have broader social networks and seem to benefit more from social integration than from emotional support. Women usually give more than they get back from emotional relationships. While men often report their spouses to be the source of emotional support, women usually experience a more adequate and available emotional support from their friends, usually a woman friend but not a spouse. In the Massachusetts Male Aging Study and Massachusetts Women's Health Study, it was demonstrated that 66% of men and 26% of women indicated their spouse as the source of emotional social support.

The dual and balanced analyses of social relationships that include the costs as well as benefits are an important starting point in understanding gender differences and how social networks may influence health. Women's social relationships are characterized as intrusive, demanding, conflict related and unsupportive, and such relationships are indicated to be related with decreased well-being. Burg and Seeman (1994) indicated that women are particularly more vulnerable to the negative impact of their social relationships, as they get more emotionally and intensively involved in relationships than men do. Studies of negative life events demonstrate that female vulnerability is largely confined to network events.

The California study in Alameda County by Berkman and Syme (1979) was one of the first large-scale studies to investigate social networks and their effects on mortality. Overall, there was an increased mortality risk in men and women who had less social networks. Older women, however, did not benefit from extended social networks.

The findings from the California study have been replicated by several other later studies, although with mixed results for men and women. As Shumaker and Hill (1991) emphasized, analyzing the quality of social networks is important in understanding how health may be improved. This is because not all networks are good for health. Some networks encourage



smoking, drug use, and the like, and thus are detrimental not only to individual health but also to the population at large.

Cohen (1988) suggested that social networks influence health in various ways: through social (stress buffering), psychological (e.g., depression, anxiety), and behavioral (e.g., promoting healthy behaviors, compliance with medical treatments) mechanisms. Ultimately, social isolation may affect physiological systems either directly or through these mechanisms. Horsten and others (Horsten, Mittleman, Wamala, Schenck-Gustafsson, & Orth-Gomér, 2000) found associations between social isolation and metabolic syndrome<sup>7</sup> and reduced heart variability in women that were not explained by behavioral risk factors such as smoking and physical inactivity.

### Gender Differences in Physiological Responses

Physiological responses to environmental stimuli seem to differ in men and women. Behaviors, social relationships, and the roles that men and women play vary and may differentially influence how men and women physiologically respond in different situations. The roles women and men are expected to play in society influence their appraisal of family or work life. Thus, the stresses from these two domains may be perceived differently and result in varying physiological responses that ultimately influence health status.

Burg and Seeman (1994) demonstrated that women reported higher levels of marital conflicts and perceived stress from the family than did men. Men's mental stress, on the other hand, is more often experienced at work and only rarely at home. Orth-Gomér and others (Orth-Gomér, Wamala, Horsten, Schenck-Gustafsson, & Mittleman, 2000) showed that women's marital problems spill over to other determinants of psychosocial health, such as anxiety, depression, perceived control, social relations, and self-esteem. A similar profile is true for men when experiencing stress at work. Wamala (2001), in a study of Swedish cohabiting working women, found that a stressful and abusive marriage contributed to a higher risk of developing a heart attack and a poorer prognosis. However, for women with a higher occupational status or high autonomy at work, marital conflicts did not seem to increase their risk for CHD.

Variations in the perception of quality of marital relations provide an empirical example of gender

differences in physiological reactions. Women demonstrate more detailed and vivid memories of marital relations (particularly negative experiences), and spend more time thinking about them than their husbands. Thus, women's stronger memories may contribute to their increased arousal to physiological responses as compared to men.

Experimental laboratory studies that measure physiological responses related to recall of stress from various situations are useful in understanding these gender differences. In the studies done by Brown and Smith (1992) and Brown, Smith, and Benjamin (1998), women, unlike men, showed more pathological physiological responses that predict a heart attack, when recalling stressors related to marital arguments, whereas similar responses were true for men when asked to recall stressors related with achievement challenge. Furthermore, Glaser, Kiecolt-Glaser, Malarkey, and Sheridan (1998), in their experimental study of physiological reactions to a marital conflict recall task, showed that marital conflicts increased levels of catecholamines,<sup>8</sup> corticotropin, and growth hormone in women but not in men. In another extended experiment by Carels, Sherwood, Szczepanski, and Blumenthal (2000), a recall of marital conflict, work conflict, and serial subtraction tasks was examined in married working women. The authors reported that elevated blood pressure was observed only when recalling stress evoked by a marital conflict. Carels et al., in their investigation of married employed women ages 25 to 45, further demonstrated that women with higher levels of marital distress exhibited greater negative emotions and higher levels of blood pressure that were more pronounced at home than at work.

Another interesting finding is that by Frankenhaeuser et al. (1989), based on middle managers at the Volvo automobile company in Sweden. A diurnal peak in urinary norepinephrine<sup>9</sup> excretion rates occurred in both men and women at about midday. Interestingly, men had decreased excretion soon after leaving the workplace, whereas women had an additionally higher peak of the catecholamines after arriving home from work.

This section emphasizes that there are more than "biological" explanations to the different physiological responses in men and women. Autonomy and control, particularly at work, seem to buffer the negative effects from the family sphere, which may influence health in a different way for men and women.

## CONCLUDING REMARKS

Macroeconomic forces, culture, and traditions create and contribute to how gender roles, distribution of power, and access to resources are patterned in society. The burden on women due to multiple roles of wage earner, parent, and caregiver is a public health concern. Both men's and women's physiology are negatively influenced by adverse working conditions. However, women's health is more often influenced by unfavorable family situations, which may be buffered by a more favorable work environment.

Gender is a dynamic concept and varies with time, generation, and changes in society. Gender differences in health can be better understood by evaluating how gender interacts with socioeconomic position and ethnicity.

Gender inequity is an important public health issue. Public health interventions should address parenting responsibilities, distribution of power and economic resources, autonomy, equal opportunities, and equal rights for men and women.

—Sarah P. Wamala and Gunnar Agren

See also WOMEN'S HEALTH ISSUES

## Notes

1. Vertical segregation occurs when some jobs are male dominated and others are female dominated.
2. Horizontal segregation refers to an unequal distribution of power and influence for men and women within the same occupational classes.
3. Emotional support refers to close emotional ties and an emotional atmosphere in which individuals can express their feelings freely and without self-consciousness.
4. Belongingness refers to the feeling of belonging to a larger group, where experiences, information, and ideas can be shared because of similar situations or similar objectives.
5. Tangible support refers to the provision of tangible goods (e.g., food, money) or task-oriented services (e.g., transportation, cooking).
6. Appraisal support refers to the communication of advice or appraisal of a situation and information relevant to self-evaluation and decision making.
7. Metabolic syndrome involves high levels of triglycerides, low levels of high-density lipoprotein (HDL; the "good" cholesterol), high blood pressure, and glucose intolerance.
8. The major catecholamines are dopamine, norepinephrine, and epinephrine. Epinephrine is a neurotransmitter in the brain but is also a major hormone in the body.

9. Norepinephrine is the primary neurotransmitter in the sympathetic nervous system and is also in the brain.

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## GENERAL ADAPTATION SYNDROME

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Modern ideas regarding stress and its effects on the body date from the classic work of physiologist Walter Cannon (1929). Cannon studied the physiological processes involved in the maintenance of homeostasis and observed what he called the *fight-or-flight* response. The fight-or-flight response involves a chain of biochemical reactions that begin with the stimulation of the cerebral cortex once the threat has been perceived. Among other responses, the cerebral cortex triggers the hypothalamus, which activates the sympathetic nervous system, which, in turn, stimulates the adrenal cortex to secrete cortisol and the adrenal medulla to secrete the hormones epinephrine and norepinephrine (catecholamines). The circulation of these hormones triggers the physiological processes associated with the fight-or-flight response, including increases in heart rate, respiration, blood pressure, blood volume, blood sugar, and blood flow to the muscles and brain, and inhibition of major bodily systems such as digestion and reproduction.

Together, these physiological changes act to increase oxygen to the brain and muscles to mobilize the system for action. These processes can provide a temporary means of survival for the organism; however, they may have undesirable physiological consequences in the event of prolonged activation.

### THE WORK OF HANS SELYE

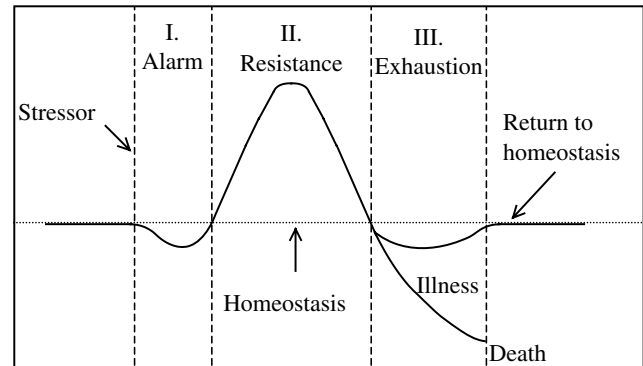
Hans Selye (1956) was the first to advance the notion of *stress* as a stimulus that elicits physiological responses to threat. Selye exposed laboratory rats to a variety of stimuli including toxins, insulin injections, electric shocks, and extreme temperatures. Extending Cannon's observation of catecholamines release, he noted that regardless of the stimulus, prolonged exposure activated the secretion of adrenocorticotrophic hormone (ACTH), which, in turn, stimulated the secretion of corticosteroids. In the short term, corticosteroids

serve to protect the body from harm by increasing energy levels through increases in blood sugar levels, reductions in immune response and inflammation of body tissue, and enhancement of muscle tone in the heart and blood vessels. However, prolonged secretion of these hormones may have the effect of increasing susceptibility to illness via increases in blood pressure, suppression of immune function, damage to muscle tissue, and weakening of the body's ability to fight infection. The observation of these nonspecific physiological processes in response to a broad range of stimuli led Selye to the formulation of the general adaptation syndrome (GAS). Thus, the physiological responses triggered by different stressful stimuli may be mediated through a common set of pathways.

### THE THREE PHASES OF THE GENERAL ADAPTATION SYNDROME

Selye hypothesized that these responses occur in three progressive phases (Figure 1). The first phase, *Alarm*, is triggered by a threatening encounter, during which the organism experiences the physiological responses involving the concurrent release of cortisol, norepinephrine, and epinephrine described by Cannon. Selye also noted that when an organism is confronted with stress, the hypothalamus activates another endocrine pathway, secondary to that noted by Cannon, in which corticosteroids are secreted from the adrenal medulla. Once the threat is eliminated, the acute physiological arousal of the Alarm phase diminishes.

During the second phase, *Resistance*, the organism's physiological systems prepare to return to normal homeostatic levels. If successful, the body will no longer show physical signs of stress. Most of the time the resistance phase is only successful in reversing the fight-or-flight response if the stressor is removed. However, if the threat continues, the organism enters a temporary state sustained by increased hormonal output that enables the organism to respond to the continuing demands of the threatening situation. While this stage is necessary for survival, the organism also incurs a physiological cost as physiological arousal remains elevated, and resistance to new stressors is weakened. If this state continues, it will eventually use up all of the energy and resources that were created to deal with the stressor, which initiates the final phase, *Exhaustion*. During the Exhaustion phase, the adaptive response to stress may be irreversibly



**Figure 1** The Three Phases of the General Adaptation Syndrome

impaired due to the depletion of physiological reserves. The body experiences adrenal exhaustion leading to decreased stress tolerance, progressive mental and physical exhaustion, illness, and collapse.

In accordance with Selye's observations, it has become apparent that cortisol release due to prolonged stress can be detrimental to several physiological systems. For example, stress can lead to high blood pressure and weight gain, two risk factors associated with cardiovascular disease and insulin resistance. Psychological disorders such as depression have also been linked to the overactivation of endocrine functioning through the continued release and depletion of norepinephrine. While the stress response to threat in the Alarm phase appears to be nonspecific, recovery from the Exhaustion phase is largely determined by the nature of the threat, its duration, and the method of coping employed by the organism. Adaptive coping responses such as stress management, relaxation, utilization of social support, and problem solving have been shown to significantly moderate the deleterious effects of prolonged stress on the organism's body systems, enabling faster recovery of stress resistance.

### ADDING AN EVALUATIVE COMPONENT: LAZARUS'S COGNITIVE-TRANSACTIONAL MODEL

The notion of coping arose from Richard Lazarus's cognitive-transactional model of stress, which defined stress as a "relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (Lazarus & Folkman, 1984, p. 19).

This definition added a psychological component to Selye's model, which was primarily developed to explain the effects of physical stressors. This new evaluative component would help explain why the sound of footsteps in a deserted alley would evoke a different response if one knows the source of the footsteps as a friend or a menacing stranger.

## CONCLUSIONS

The study of stress remains a central theme in health psychology, and its treatment remains a central concern of behavioral medicine. Yet, theorists continue to debate the precise meaning of the term *stress*, and controversy continues to exist concerning how it is measured, and the means by which it may be implicated in different pathophysiological states. The general adaptation syndrome was a useful organizing principle in that it provided a theoretical framework for understanding why a broad array of physical and psychological stimuli may act on common physiological pathways, and how stress may be implicated in chronic disease.

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See also ALLOSTASIS, ALLOSTATIC LOAD, AND STRESS;

CARDIOVASCULAR REACTIVITY; IMMUNE RESPONSES TO STRESS; PSYCHONEUROIMMUNOLOGY; PSYCHOPHYSIOLOGY; THEORY AND METHODS; STRESS, APPRAISAL, AND COPING; STRESS: BIOLOGICAL ASPECTS

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## GENETIC TESTING: ETHICAL, LEGAL, AND SOCIAL ASPECTS

Genetic advances raise questions of enormous importance to individuals and societies. Genes define our individual identity, while simultaneously linking us to family, ethnic group, and species. Genetic testing results that identify inherited predisposition for disease can define a state between illness and wellness. In some cases, identification as the carrier of a disease-predisposing mutation has implications for prognosis and for targeted prevention, early diagnosis, and possibly even treatment recommendations. In other cases, information about mutation status may have few immediate ramifications beyond the psychological impact of the knowledge itself.

Utilization of the end products of genetic research is dependent on what people understand about genetic testing, on social and individual attitudes toward genetics, and on the emotional state and life experiences of the potential users. The ultimate success of recent genetic advances including the cloning of the human genome is dependent on an informed public's awareness of the potential benefits and the risks of increased genetic knowledge. Success is further aided by the availability of appropriate genetic counseling and psychological services. These services can provide needed information, optimize decision making, improve individualized consideration of potential emotional and interpersonal consequences of genetic testing, and offer support to individuals and families coping with the burden and challenge of genetic knowledge.

## GENETIC TESTING

Genetic testing is a process whereby an individual's DNA, derived from a blood sample, is sequenced to determine if there are mutations or changes from the usual sequence that may indicate an inherited predisposition to disease. Genetic testing is not available for all hereditary diseases. Conditions such as sickle cell disease or phenylketonuria (PKU), which are the result of genetic mutations, can be identified by physical changes in the body that are

present at birth, so genetic testing is unnecessary. For many other hereditary conditions, however, it is impossible to identify carriers of disease predispositions prior to the onset of the illness, which often occurs in adulthood. With increasing genetic knowledge, tests have been developed for some hereditary conditions so that those who are tested can learn whether or not they carry disease-predisposing mutations.

To date, genetic testing has been available largely for Huntington's disease and for some cancer genes. Huntington's disease and hereditary breast, ovarian, and colon cancers are each caused by mutations in a single gene. The inherited predispositions that result from these mutations are guided by the principles of Mendelian genetics and are inherited in autosomal dominant patterns. This means that children of mothers or fathers who are mutation carriers have a 50-50 chance of inheriting the deleterious mutation. Whether or not the disease actually develops varies with the penetrance of the gene, which is the extent to which those who have the genetic mutation (the genotype) exhibit the disease or other characteristic (the phenotype). Penetrance varies with the population being considered. Most cancer genes, however, typically convey risks that are many times the risk of individuals in the general population. For example, the lifetime risk of breast cancer in women who are BRCA1/2 carriers ranges from 56% to 85%, compared to the risk for a woman in the general population, which is 1 in 8 or 1 in 9 (11-12%). Inherited mutations are thought to account for about 5% to 10% of all cancers.

In the future, we will understand more about other complex patterns that govern the inheritance of predisposition to both physical and psychiatric diseases. These patterns sometimes involve combinations of genes that must *all* be altered to trigger disease onset. Some hereditary disease predispositions also involve interactions between genes and environmental factors. This increasing complexity of genetic information challenges psychologists and genetics professionals to improve methods of information delivery to patients and health professionals. Since the basis of all ethical research and treatment is a reasonable understanding by those involved of the issues at hand, finding methods to improve and customize patient, public, family, and professional understanding of genetics is a critical aspect of the social integration of the new genetics.

### When Should Testing Be Made Available?

There are many concerns about when it is ethical to offer genetic testing. Important issues include whether testing should be available as soon as it becomes possible or whether it should be offered only when there are treatments or prevention strategies for the condition that the genetic mutation causes. Other questions concern the standards that should be established for genetic tests and how they should be upheld, and whether children should be tested for adult-onset disorders. Further ethical issues relate to whether one company should hold a patent for the test of a particular gene, effectively forcing all competitors from the market, and whether genetic testing should be marketed directly to members of the public.

There is a gap in public understanding about the steps that are necessary between the discovery of a gene in a laboratory setting and the reality of clinical genetic testing for the condition. Some blame this gap on the intense media attention that surrounds the discovery of a disease gene. They fault reporters' tendencies to leap ahead to describing the ultimate utility of the work without adequate caution about the scientific and medical problems that must be resolved before such goals can be realized.

This problem is confounded by the fact that, to find the disease gene, scientists must often get genetic samples from patients with the condition and their relatives. These individuals have a vested interest in the outcomes of the studies, although typically they are not given results of their own research testing, even once the gene is identified. This is because laboratory testing and testing for clinical purposes are governed by different standards of accuracy. It is crucial that individuals participating in such research efforts understand that they will likely not benefit personally from the testing. They may become part of a registry or group whose members are informed about the availability of genetic testing as soon as clinical testing becomes possible, but they will likely also need genetic counseling prior to getting the test results, so that they fully understand the consequences of testing. They will probably also have to provide another blood sample to be tested in a clinically approved (CLIA) laboratory.

The first genetic test for a major disorder was for Huntington's disease (HD), a progressive neurological disorder for which neither preventive nor curative treatments are available. The 100% penetrance of the

HD gene means that all who carry the mutation will develop the disease during their lifetime. Contrary to expectations of high interest among healthy relatives of HD patients based on surveys done prior to identification of the HD gene, uptake of testing has been minimal. Only about 10% of at-risk members of HD families have requested testing. Those who are tested say they seek resolution of the uncertainty that colors their lives and information to better plan their futures. There is relief for those found not to be carriers, although many also feel something like “survivor guilt” for family members who are not as lucky. Most of those found to be carriers say they prefer to have knowledge of their mutation status, although some depression and rare adverse outcomes are also reported.

People at increased hereditary disease risk appear to find the prospect of knowing their genetic status more appealing when it is hypothetical; when testing becomes possible, anxiety about the impact of the knowledge appears to impede uptake. Pretest interest among at-risk individuals was also not predictive of uptake of genetic testing for the BRCA1/2, the first two genes for hereditary breast and ovarian cancer. About a third to a half of at-risk individuals in selected samples of breast-ovarian cancer families have requested testing.

The patent for the BRCA1/2 mutations is held by Myriad Genetics, Inc., a private company that participated in the search for the genes and won the patent rights. Hence, all commercial BRCA1/2 testing has to be done by Myriad. Currently, there is some concern in the genetics world because Myriad is marketing the genetic test for BRCA1/2 directly to consumers. Many feel this is inappropriate, since it pressures individuals to be tested without adequate counseling about the limitations and alternatives to genetic testing and with insufficient preparation for possible adverse outcomes of having knowledge of one's genetic status.

### Who Should Have Access to Genetic Testing?

There is concern that many of the people to date who have sought and received genetic testing have been well-educated, Caucasian individuals from upper socioeconomic stratas. This is a function of many factors, but there are efforts under way to increase the availability of testing to minorities and cultural subgroups of the population. This is a complex

issue as it involves not merely translation of consent forms into non-English languages but more challenging issues of defining subpopulations; discovering and addressing stereotypes about research, in general, and genetics, more specifically; ensuring access to prevention and screening programs; and determining who the most trusted leaders are of any community whose aid may be needed to help introduce genetic testing to that community.

Another issue concerning cultural subgroups is the fact that some groups have been found to carry particularly high rates of disease-predisposing mutations. Within the Ashkenazi Jewish population, about 90% of mutations in BRCA1/2 are accounted for by two mutations in BRCA1 and one in BRCA2. This is due to what is called a *founder effect*, the increased presence in a population of a particular genetic mutation due to many centuries of restricted breeding within the group. Founder effects have also been observed in subpopulations of many other ethnic or cultural groups, but often not to the degree represented in the Ashkenazi Jewish population. This means that people who are Ashkenazi Jewish who do not know whether there is a BRCA1/2 mutation in their family and who do not have a living relative with breast or ovarian cancer who could be tested can still themselves be tested to see if they carry one of these three mutations. Testing for three mutations is about one tenth the cost of sequencing the entire gene. A positive test result would inform individuals that they are at increased risk of breast and ovarian cancer. A negative test, however, is not informative, since it is possible that, in their family, it is a different mutation that is responsible for increased rates of breast or ovarian cancer or it is possible that there is no inherited predisposition. This kind of negative result, then, is said to be “uninformative.”

The reaction to offering this kind of “panel” testing to Ashkenazi Jewish populations has varied widely. Some groups and their leaders have welcomed testing, feeling that having additional knowledge about disease risk is empowering. Other groups and leaders have been skeptical about the idea of isolating any subpopulation as carrying deleterious genes. They fear that this could have adverse social consequences, including discrimination. The issues raised by the availability of specialized testing within genetic subpopulations and the fact that future genetic research on genetic variation is likely to reveal unexpected differences and similarities within established social,

ethnic, and religious groups suggests a need for increased attention to the interface between culture, society, and medicine.

There are also questions about whether children should have genetic testing for conditions that do not occur until adulthood, such as breast and ovarian cancer or HD. The consensus has been that genetic testing for these conditions should be deferred so that persons can decide for themselves when they become adults whether they want to know their personal genetic risk. This attitude is supported by the finding that so many at-risk adults have opted against testing for themselves.

Sometimes, it is difficult for parents who are mutation carriers to accept that they must live for many years with uncertainty about whether their children carry the same mutation. If preventive interventions are developed that are usefully initiated in childhood, it is very likely that attitudes toward the testing of children for these conditions will change. It is currently the case that children at risk for familial adenomatous polyposis (FAP), an inherited form of colon cancer, are offered genetic testing, since preventive interventions for children in families in which FAP has occurred in adults are typically initiated around the age of 10. Genetic testing allows for the identification of the 50% of children in the family who do not carry mutations in the gene responsible for FAP, the APC gene. The children found not to be carriers do not need to undergo the repeated colonoscopies that are used to determine, often by age 16 or so, if and when part or all of an at-risk child's colon should be removed to prevent the occurrence of colon cancer. There is some research on the effects of genetic testing for APC mutations on children in FAP families that suggests that although most children do not have depression or anxiety reactions in the clinical range, some patients do have increased distress and, in one study, a tenth of the children said they regretted knowing their genetic risk status.

### **What Is the Impact of Learning That One Is at Increased Hereditary Risk for Disease?**

Research on the psychosocial impact of genetic testing indicates a mixed picture. Learning that one is a carrier of a predisposition gene, such as BRCA1/2 or the gene for HD, for serious physical and neurological conditions does not typically occasion immediate, severe adverse effects, as had been feared at the

beginning of the genetic testing era. Most people react with disappointment and some short-term distress. However, it appears that there is a subset of individuals for whom receiving news of their positive test result triggers depression, increased anxiety, and/or diminished self-esteem.

The interaction between baseline levels of distress, personality style, medical history, test result, and medical and psychosocial outcomes will be a topic of intense interest in the coming decade. This will be especially true as testing occurs with greater frequency outside of the research programs from which most current outcome data emanate. (Those programs offered extensive genetic counseling and often, free testing; these factors might well have influenced patients' satisfaction with the testing experience.) The distinction between "monitors," those who actively seek personal medical information, and "blunters," those who prefer to avoid thinking about such matters, is often invoked in distinguishing between those who believe that knowing their genetic status will empower them and those who find such knowledge unnecessarily distressing. Further study will spur development of counseling techniques targeted to the cognitive style and personality of the patient.

The ultimate goal of identifying those at increased hereditary risk for disease is to reduce morbidity and mortality and to diminish human suffering related to disease. Anxiety is a moderator of the relationship between knowledge and action. Some level of worry about developing the illness in question is necessary for an individual to take preventive action or to regularly undergo screening to detect the disease at the earliest possible point. When the level of risk is low, it is likely that undergoing screening will result in positive reassurance that the disease or its precursors are not present. However, if genetic testing indicates that an individual has a vastly increased disease risk, his or her anxiety about becoming ill is likely to increase, possibly interfering with getting recommended screenings or undertaking preventive measures. In such a case, the fruits of the genomic revolution are not realized. Rather, knowledge of genetic risk might actually increase the chances that the disease will not be discovered until it is so advanced that the most effective treatments are useless. This represents a challenge that must be addressed if the increasing knowledge about hereditary aspects of illness is to serve its intended purpose of reducing the burden of disease on those families and individuals with hereditary predispositions.



### What Are the Social Risks of Learning One's Personal Genetic Risk Status?

There has been much less reported insurance and other discrimination based on genetic test results than originally feared. Some contend that this means that the envisioned use of genetic test results by insurers to discriminate against mutation carriers has been overblown, often with the unintended effect of scaring at-risk individuals away from seeking genetic services. Others say it would be unwise to abandon efforts to protect genetic privacy now. They contend that the rarity of genetic discrimination is only because insurers are just now figuring out ways to get and evaluate genetic test data and to recalculate individual risk using genetic information. Many states and the federal government are working on legislation to protect genetic information, but there is no way that laws can fully protect people who want their genetic information to remain completely private. A Web site maintained by the Health Privacy Project at Georgetown University summarizes relevant state regulations and includes the definitions of terms used in the state laws (<http://www.healthprivacy.org>).

There are also questions about what the obligations of others are to protect those who do not want to learn their own genetic status from the information. Some ethicists have argued that there is a "right not to know," just as there is a right (at least of adults) to have information about their genetic makeup, if it is possible to know it and if they are willing to pay for and undergo testing. These questions, as well as issues about whether there is a duty to continually update patients and family members about changes in our knowledge about the mutations they carry, will create fertile arenas for psychological studies of attitudes and of the impact of different interpretations of "fairness" in the genetics context. Such data will be of great interest to those charged with making genetics policy.

### PSYCHIATRIC GENETICS

Genetics will have marked impact not only on our understanding of medical conditions but also on the definition and treatment of psychiatric disorders. Identification of the genetic basis for conditions such as Prader-Willi syndrome (PWS), the definition of which had previously relied solely on behavioral factors, allows for greater clarity in defining the

syndrome and diagnosing affected individuals. PWS is a genetic disorder characterized by a complex and variable symptom configuration including behavioral, cognitive, and physical abnormalities. Possible symptoms include lifelong hypotonia, insatiable appetite, short stature, and obsessive-compulsive behaviors, among others. Knowledge of the underlying genetic cause for the syndrome also provides new direction to the search for treatment and cure of PWS.

For many other psychiatric conditions, the genetic basis may be considerably more complicated. Nonetheless, as the interactions between genes or between genes and environmental factors are worked out, our knowledge and understanding of many psychiatric conditions and behavioral states are likely to greatly improve. It will be important that at-risk individuals and family members receive counseling about the implications of knowing whether or not there is a clear hereditary factor responsible for the illness in the family. Knowledge of a genetic etiology for childhood psychiatric disorders may remove some stigma from parents as the "cause" of their child's illness. However, stigma may attach instead to the child being a carrier of a mutation-conveying genetic predisposition to a mental disorder or disease.

### FAMILY COMMUNICATION

The presence of an inherited disease predisposition affects family life and communication between relatives in many ways. In turn, the nature of the communication between family members affects the manner in which genetic information is disseminated within the family and the medical and psychological outcomes of genetic testing.

Genetic counseling and testing necessitate the gathering of accurate information about family history, specifically, knowledge of which relatives had which diseases at what ages. To determine if there is a likely hereditary process involved, it is also often necessary to have quite specific information about the diagnosed illnesses and related conditions. These details often lead to intimate conversations between relatives who may not otherwise know each other particularly well. They may also uncover difficult and sometimes new information about the nature and course of a relative's illness, which may prove quite upsetting to some family members. Women are the prime carriers of familial information about illness. When the hereditary disease also primarily affects

women (such as in hereditary breast and ovarian cancer families), the premature death of many women may complicate access to accurate information about family medical history.

Genetic testing usually only gives definitive results when a family member with cancer (or other disease of hereditary etiology) is tested first. This may lead to the possibility of some relatives being pressured or even coerced to be tested, who would not themselves have sought testing. Difficult ethical conflicts may arise between one individual's desire for testing and that individual's dependence on the willingness of another, reluctant relative's decision about whether or not to undergo testing altruistically for the benefit of others in the family. Whose autonomy counts most? This issue, while resolved harmoniously in many families, can, in others, create deeply felt resentments. Psychological consultation can be useful in resolving such controversies.

## FUTURE GENETIC INTERVENTIONS

Pharmacogenetics promises medicines targeted to the particular, inherited characteristics of the person for whom it is prescribed. The hope is that by understanding the genetics that govern the way a particular drug is ingested and absorbed by different people, special forms of the medication can be produced for those different groups of consumers, thereby reducing side effects, toxicity, and underdosing. Testing for those genes that determine drug response may become quite common, bringing with it ethical concerns about who possesses and stores knowledge of gene status related to drug sensitivities.

Gene therapy is an ultimate goal of much of the new genetics. The hope is that by enlarging our understanding of gene function, we will be better able not only to identify carriers of disease-predisposing genetic mutations but also to treat the resulting conditions or to prevent disease development. However, use of gene therapy raises ethical and psychological issues related to determination of which conditions merit remediation and when treatment leads down a slippery slope of seeking endlessly for human perfection. Questions arise about who will have access to this expensive therapy and whether our approach to individuals with disabilities will be changed by the possibility of genetically "fixing" many hereditary conditions. Issues of patient and family understanding and informed consent become more salient as new,

complicated, genetic treatments are developed that may have many unforeseen side effects.

Advances in genetics brought about by the Human Genome Project will change many aspects of medical care in coming decades and will likely alter our conceptions of race, gender, and the health-illness continuum. Mental health professionals in clinical settings will see increasing numbers of patients with concerns about the identification of risk for inherited disease predisposition and related family issues. Psychologists and other social scientists contribute to our understanding of the impact of genetic advances on individuals, families, and society. Research on the acceptance, uptake, and outcomes of genetic testing, much of it sponsored by the Ethical, Legal, and Social Implications (ELSI) program of the National Institute of Human Genome Research, is helping to answer questions about the ways in which people understand genetic information and when and how that information can be utilized to reduce human distress. Research on social and psychological outcomes of genetic testing is advanced by the 5% of the Human Genome budget devoted to the study of ethical, legal, and social implications. The ELSI program represents a remarkable advance in medically related social science research in its insistence on concurrent study of the social issues and problems resulting from advancing scientific knowledge. Its goals include minimizing adverse effects and improving access for all social groups to new genetic information and the resulting tests and treatments.

To keep abreast of changing genetic knowledge requires continuing education. Web sites maintained by the National Human Genome Research Institute (<http://www.genome.gov/>), the National Cancer Institute ([www.cancernet.org](http://www.cancernet.org)), and others are valuable resources. The National Coalition for Health Professional Education in Genetics (NCHPEG) ([www.nchpeg.org](http://www.nchpeg.org)) is also developing resources to broaden the genetic understanding of health professionals.

—Andrea Farkas Patenaude

See also BEHAVIORAL GENETICS AND HEALTH; CANCER PREVENTION; CANCER SCREENING

## Further Reading

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# Appendix A

## Online Resources and Health and Behavior Organizations

Agency for Healthcare Research and Quality  
2101 E. Jefferson Street, Suite 501  
Rockville, MD 20852  
Telephone: 301-594-1364  
<http://www.ahrpr.gov/>

According to its Web site, the “mission of the Agency for Health Care Policy and Research is to support, conduct, and disseminate research that improves access to care and the outcomes, quality, cost, and utilization of health care services. The research sponsored and conducted by the Agency provides better information that enables better decisions about health care” (in 1999, the Agency for Health Care Policy and Research changed its name to the Agency for Healthcare Research and Quality, AHRQ).

Alan Guttmacher Institute  
120 Wall Street, 21st Floor  
New York, NY 10005  
Telephone: 212-248-1111  
[www.agi-usa.org/](http://www.agi-usa.org/)

The Alan Guttmacher Institute is a nonprofit organization focused on sexual and reproductive health research, policy analysis, and public education. The institute’s mission is to protect the reproductive choices of all women and men in the United States and throughout the world. It is to support their ability to obtain the information and services needed to achieve their full human rights, safeguard their health, and exercise their individual responsibilities in regard to sexual behavior and relationships, reproduction, and family formation.

Alzheimer’s Association  
225 North Michigan Avenue, Suite 1700  
Chicago, IL 60601-7633  
Telephone: 312-335-8700  
<http://www.alz.org/>

The Alzheimer’s Association, a national network of chapters, is the largest national voluntary health organization dedicated to advancing Alzheimer’s research and helping those affected by the disease. Having awarded \$136 million in research grants, the association ranks as the top private funder of research into the causes, treatments, and prevention of Alzheimer’s disease. The association also provides education and support for people diagnosed with the condition, their families, and caregivers.

American Academy of Child and Adolescent Psychiatry  
3615 Wisconsin Avenue N.W.  
Washington, DC 20016-3007  
Telephone: 202-966-7300  
<http://www.aacap.org>

The American Academy of Child and Adolescent Psychiatry (AACAP) is a membership-based organization, composed of more than 6,500 child and adolescent psychiatrists and other interested physicians. Its members actively research, evaluate, diagnose, and treat psychiatric disorders and pride themselves on giving direction to and responding quickly to new developments in addressing the health care needs of children and their families.

American Academy of Nursing  
600 Maryland Avenue, S.W., Suite 100 West  
Washington, DC 20024-2571  
Telephone: 202-651-7238  
[www.nursingworld.org/aan/](http://www.nursingworld.org/aan/)

The American Academy of Nursing is constituted to potentiate the contributions of nursing leaders in transforming the health care system to optimize public well-being. This leadership is grounded in a global perspective, enriched by diversity, and actualized through partnerships with other health care and consumer groups.

American Academy of Pediatrics  
141 Northwest Point Boulevard  
Elk Grove Village, IL 60007-1098  
Telephone: 847-434-4000  
<http://www.aap.org/>

The American Academy of Pediatrics (AAP) and its member pediatricians dedicate their efforts and resources to the health, safety, and well-being of all infants, children, adolescents, and young adults. The AAP has 57,000 members in the United States, Canada, and Latin America. Members include pediatricians, pediatric medical subspecialists, and pediatric surgical specialists. More than 41,000 members are board certified and are called Fellows of the American Academy of Pediatrics (FAAP).

American Association of Colleges of Nursing  
One Dupont Circle, N.W., Suite 530  
Washington, DC 20036  
Telephone: 202-463-6930  
<http://www.aacn.nche.edu/>

The American Association of Colleges of Nursing (AACN) is the national voice for America's baccalaureate- and higher-degree nursing education programs. AACN's educational, research, government advocacy, data collection, publications, and other programs work to establish quality standards for bachelor's- and graduate-degree nursing education, assist deans and directors to implement those standards, influence the nursing profession to improve health care, and promote public support of baccalaureate and graduate education, research, and practice in nursing.

American Association of Spinal Cord Injury Psychologists  
and Social Workers  
75-20 Astoria Boulevard.  
Jackson Heights, NY 11370

Telephone: 718-803-3782  
<http://www.aascipsw.org/>

The American Association of Spinal Cord Injury Psychologists and Social Workers (AASCIPSW) is an organization of psychologists and social workers who provide for the emotional, behavioral, and psychosocial care of persons affected by spinal cord impairment (SCI). AASCIPSW, incorporated in 1986, operates exclusively for scientific, charitable, and educational purposes. AASCIPSW provides members the opportunity to develop and refine leadership skills through active participation in the association.

American Association of Suicidology  
4201 Connecticut Avenue, N.W., Suite 408  
Washington, DC 20008  
Telephone: 202-237-2280  
[www.suicidology.org/](http://www.suicidology.org/)

The goal of the American Association of Suicidology (AAS) is to understand and prevent suicide. AAS promotes research, public awareness programs, public education, and training for professionals and volunteers. In addition, AAS serves as a national clearinghouse for information on suicide. The membership of AAS includes mental health and public health professionals, researchers, suicide prevention and crisis intervention centers, school districts, crisis center volunteers, survivors of suicide, and a variety of laypersons who have an interest in suicide prevention.

American Cancer Society  
<http://www.cancer.org>  
Telephone: 1-800-ACS-2345

The American Cancer Society (ACS) is a nationwide, community-based voluntary health organization. With chartered divisions throughout the country and more than 3,400 local offices, the ACS is committed to fighting cancer through balanced programs of research, education, patient service, advocacy, and rehabilitation.

American College of Preventive Medicine  
1307 New York Avenue, N.W., Suite 200  
Washington, DC 20005  
Telephone: 202-466-2044  
[www.acpm.org](http://www.acpm.org)

The American College of Preventive Medicine (ACPM) is the national professional society for physicians committed to disease prevention and health promotion.

American Counseling Association  
5999 Stevenson Avenue  
Alexandria, VA 22304  
Telephone: 1-800-347-6647  
[www.counseling.org](http://www.counseling.org)

The American Counseling Association (ACA) is a not-for-profit, professional and educational organization dedicated to the growth and enhancement of the counseling profession. Founded in 1952, ACA is the world's largest association exclusively representing professional counselors in various practice settings. ACA has been instrumental in setting professional and ethical standards for the counseling profession.

American Diabetes Association  
National Center  
1701 North Beauregard Street  
Alexandria, VA 22311  
Telephone: 1-800-DIABETES (1-800-342-2383)  
[www.diabetes.org](http://www.diabetes.org)

The American Diabetes Association is the nation's leading nonprofit health organization providing diabetes research, information, and advocacy. The mission of the organization is to prevent and cure diabetes and to improve the lives of all people affected by diabetes.

American Heart Association  
National Center  
7272 Greenville Avenue  
Dallas, TX 75231  
Telephone: 1-800-AHA-USA-1 or 1-800-242-8721  
[www.americanheart.org](http://www.americanheart.org)

The American Heart Association is a national voluntary health agency whose mission is to reduce disability and death from cardiovascular diseases and stroke.

American Institute of Stress  
124 Park Avenue  
Yonkers, NY 10703  
Telephone: 914-963-1200  
<http://www.stress.org/>

The American Institute of Stress is committed to developing a better understanding of how to tap into the vast innate potential that resides in each of us for preventing disease and promoting health.

American Psychiatric Association  
1000 Wilson Boulevard, Suite 1825

Arlington, VA 22209-3901  
Telephone: 703-907-7300  
[www.psych.org](http://www.psych.org)

The American Psychiatric Association is a medical specialty society recognized worldwide. Its 37,000 U.S. and international member physicians work together to ensure humane care and effective treatment for all persons with mental disorders, including mental retardation and substance-related disorders. It is the voice and conscience of modern psychiatry. Its vision is a society that has available accessible quality psychiatric diagnosis and treatment.

American Psychological Association  
750 First Street, N.E.  
Washington, DC 20002-4242  
Telephone: 1-800-374-2721 or 202-336-5500  
[www.apa.org](http://www.apa.org)

The American Psychological Association (APA) is a scientific and professional organization that represents psychology in the United States. With more than 155,000 members, APA is the largest association of psychologists worldwide. APA's initiatives include supporting psychology as a science, profession, and means to improve health and human welfare; educating the public and the media on the value of psychology; advocating in legislatures, educational settings, and major social institutions on behalf of the discipline and psychologists; and working to advance education and training in psychology from preschool to postdoctorate levels.

American Psychological Society  
1010 Vermont Avenue N.W., Suite 1100  
Washington, DC 20005-4907  
Telephone: 202-783-2077  
<http://www.psychologicalscience.org/>

The mission of the American Psychological Society (APS) is to promote, protect, and advance the interests of scientifically oriented psychology in research, application, teaching, and the improvement of human welfare. The APS is a nonprofit membership organization founded in 1988 to advance scientific psychology and its representation as a science on the national level. APS grew quickly, surpassing 5,000 members in its first 6 months. In 2003, APS membership exceeded 13,500 and includes the leading psychological scientists and academics, clinicians, researchers, teachers, and administrators.

American Psychosocial Oncology Society  
2365 Hunters Way  
Charlottesville, VA 22911  
Telephone: 434-293-5350  
[www.apos-society.org/](http://www.apos-society.org/)

The mission of American Psychosocial Oncology Society is to promote the psychological, social, and physical well-being of patients with cancer and their families at all stages of disease and survivorship through clinical care, education, research, and advocacy.

American Psychosomatic Society  
6728 Old McLean Village Drive  
McLean, VA 22101-3906  
Telephone: 703-556-9222  
[www.psychosomatic.org](http://www.psychosomatic.org)

The mission of the American Psychosomatic Society is to promote and advance the scientific understanding of the interrelationships among biological, psychological, social, and behavioral factors in human health and disease, and the integration of the fields of science that separately examine each, and to foster the application of this understanding in education and improved health care.

American Public Health Association  
800 I Street, N.W.  
Washington, DC 20001  
Telephone: 202-777-2742  
<http://www.apha.org/>

The American Public Health Association (APHA) is the oldest and largest organization of public health professionals in the world, representing more than 50,000 members from over 50 occupations of public health. APHA brings together researchers, health service providers, administrators, teachers, and other health workers in a unique, multidisciplinary environment of professional exchange, study, and action. APHA is concerned with a broad set of issues affecting personal and environmental health, including federal and state funding for health programs, pollution control, programs and policies related to chronic and infectious diseases, a smoke-free society, and professional education in public health.

American Social Health Association  
P.O. Box 13827  
Research Triangle Park, NC 27709  
Telephone: 919-361-8400  
<http://www.ashastd.org/>

The American Social Health Association is recognized by the public, patients, providers, and policymakers for developing and delivering accurate, medically reliable information about sexually transmitted diseases.

American Society for Clinical Nutrition  
9650 Rockville Pike  
Bethesda, MD 20814-3998  
Telephone: 301-530-7110  
[www.faseb.org/ascn/](http://www.faseb.org/ascn/)

The American Society for Clinical Nutrition (ASCN) is the clinical division of the American Society for Nutritional Sciences. The goals and objectives of the ASCN are to encourage and implement undergraduate and graduate education in basic and clinical nutrition, particularly in medical schools; expand research and clinical training opportunities in nutrition science for health professionals; and provide opportunities for investigators to present and discuss current research in human nutrition.

American Society for Nutritional Sciences  
9650 Rockville Pike, Suite 4500  
Bethesda, MD 20814  
Telephone: 301-530-7050  
[www.asns.org/](http://www.asns.org/)

The American Society for Nutritional Sciences is the premier research society dedicated to improving the quality of life through the science of nutrition.

American Sociological Association  
1307 New York Avenue, N.W., Suite 700  
Washington, DC 20005  
Telephone: 202-383-9005  
<http://www.asanet.org/>

The American Sociological Association (ASA) is a membership association dedicated to advancing sociology as a scientific discipline and profession serving the public good. With approximately 13,000 members, ASA encompasses sociologists who are faculty members at colleges and universities, researchers, practitioners, and students.

Association for Applied Psychophysiology and Biofeedback  
10200 W. 44th Avenue, Suite 304  
Wheat Ridge, CO 80033-2840, USA  
Telephone: 303-422-8436  
[www.aapb.org](http://www.aapb.org)

The mission of the Association for Applied Psychophysiology and Biofeedback (AAPB) is to advance the development, dissemination, and utilization of knowledge about applied psychophysiology and biofeedback to improve health and the quality of life through research, education, and practice. The goals of the association are to promote a new understanding of biofeedback and advance the methods used in this practice.

Association for the Advancement of Behavior Therapy  
305 7th Avenue, 16th Floor  
New York, NY 10001  
Telephone: 212-647-1890  
[www.aabt.org](http://www.aabt.org)

The Association for the Advancement of Behavior Therapy (AABT) is a professional, interdisciplinary organization that is concerned with the application of behavioral and cognitive sciences to the understanding of human behavior, developing interventions to enhance the human condition, and promoting the appropriate utilization of these interventions. AABT is a not-for-profit membership organization of more than 4,500 mental health professionals and students who are interested in behavior therapy and cognitive behavior therapy in order to gain a better understanding of human behavior; develop, assess, and apply interventions to assist in behavior change; help people deal with personal and social problems and issues; and further the empirical study, theory, and practice of these therapies.

Association of Behavior Analysis  
1219 South Park Street  
Kalamazoo, MI 49001  
Telephone: 269-492-9310  
<http://www.abainternational.org/>

The mission of the Association of Behavior Analysis is to develop, enhance, and support the growth and vitality of behavioral analysis through research, education, and practice.

Association of State and Territorial Directors of  
Health Promotion and Public Health Education  
1101 15th Street, N.W., Suite 601  
Washington, DC 20005  
Telephone: 202-659-2230  
[www.astdhphe.org](http://www.astdhphe.org)

The Association of State and Territorial Directors of Health Promotion and Public Health Education

(ASTDHPHE) was founded in 1946 (as the Conference of State Directors of Public Health Education) as a joint effort between directors of health education in state health departments and deans of health education in schools of public health. In 1994, the association changed its name to the Association of State and Territorial Directors of Health Promotion and Public Health Education to better reflect the mission and roles of the membership in promoting health and preventing disease in states and communities.

Association of Teachers of Preventive Medicine  
1660 L Street, N.W., Suite 208  
Washington, DC 20036  
Telephone: 202-463-0550  
<http://www.atpm.org/>

The Association of Teachers of Preventive Medicine (ATPM) is the national association supporting health promotion and disease prevention educators and researchers. Since 1942, ATPM and its members have been in the forefront of advancing, promoting, and supporting health promotion and disease prevention in the education of physicians and other health professionals.

Behavior OnLine  
[www.behavior.net/about.html](http://www.behavior.net/about.html)

Behavior OnLine aspires to be the premier World Wide Web gathering place for mental health professionals and applied behavioral scientists—a place where professionals of every discipline can feel at home.

Center for Behavioral Neuroscience  
[www.cbn-atl.org](http://www.cbn-atl.org)

The Center for Behavioral Neuroscience examines the neural mechanisms underlying the social behaviors that are essential for species survival, such as fear, affiliation, aggression, and reproductive behaviors.

Center for Communication Programs  
Johns Hopkins Bloomberg School of Public Health  
111 Market Place, Suite 310  
Baltimore, MD 21202  
Telephone: 410-659-6300  
[www.jhuccp.org/](http://www.jhuccp.org/)

The Center for Communication Programs (CCP) works with international agencies, foundations, governments, and nongovernmental organizations in the United States and overseas to promote healthy behavior.



The CCP's work focuses on the field of strategic, research-based communication for behavior change and health promotion that has helped transform the theory and practice of public health.

Center for the Advancement of Health  
2000 Florida Avenue, N.W., Suite 210  
Washington, DC 20009-1231  
Telephone: 202-387-2829  
[www.cfah.org/](http://www.cfah.org/)

The Center for the Advancement of Health promotes a view of health that recognizes that where we live, how we are educated, and what we eat, drink, breathe, and do affect health as much as, if not more than, access to health care. Its mission is to translate research on this expanded view of health into effective policy and practice.

Centers for Disease Control and Prevention  
1600 Clifton Road  
Atlanta, GA 30333  
Telephone: 404-639-3311  
[www.cdc.gov](http://www.cdc.gov)

The Centers for Disease Control and Prevention (CDC) is recognized as the lead federal agency for protecting the health and safety of people, at home and abroad, providing credible information to enhance health decisions and promoting health through strong partnerships. The CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States. The CDC's mission is to promote health and quality of life by preventing and controlling disease, injury, and disability.

College on Problems of Drug Dependence  
3420 N. Broad Street  
Philadelphia, PA 19140  
Telephone: 215-707-3242  
<http://www.cpdd.vcu.edu/>

The College on Problems of Drug Dependence (CPDD), formerly the Committee on Problems of Drug Dependence, has been in existence since 1929 and is the longest-standing group in the United States addressing problems of drug dependence and abuse. CPDD serves as an interface among government, industrial, and academic communities maintaining liaisons with regulatory and research agencies as well

as educational, treatment, and prevention facilities in the drug abuse field. It also functions as a collaborating center of the World Health Organization.

Commission on Accreditation of Rehabilitation Facilities  
4891 E. Grant Road  
Tucson, AZ 85712  
Telephone: 520-325-1044  
[www.carf.org](http://www.carf.org)

The Commission on Accreditation of Rehabilitation Facilities (CARF) is an independent, not-for-profit accrediting body promoting quality, value, and optimal outcomes of services through a consultative accreditation process that centers on enhancing the lives of the persons receiving services. Founded in 1966 as the Commission on Accreditation of Rehabilitation Facilities, the accrediting body is now known as CARF. The mission of CARF is to promote the quality, value, and optimal outcomes of services through a consultative accreditation process that centers on enhancing the lives of the persons served.

Consortium of Social Science Associations  
1522 K Street, N.W., Suite 836  
Washington, DC 20005  
Telephone: 202-842-3525  
<http://www.cossa.org/>

The Consortium of Social Science Associations (COSSA) is an advocacy organization supported by more than 100 professional associations, scientific societies, universities, and research institutions. COSSA stands alone in representing the full range of social scientists. COSSA represents the needs and interests of social and behavioral scientists; educates federal officials about social and behavioral science; informs the science community about relevant federal policies; and cooperates with other science and education groups in pursuit of common goals. COSSA lobbies Congress and the Executive Branch on issues affecting the social science portfolios of the National Science Foundation, the National Institutes of Health, the Departments of Agriculture, Commerce, Education, Justice, and Labor, and many other federal agencies.

Council of Graduate Departments of Psychology  
<http://psych.wfu.edu/cogdop/>

The Council of Graduate Departments of Psychology (COGDOP) is a society constituted of chairs and heads of departments of psychology or other equivalent administrative units, which are authorized to offer

graduate degrees in psychology in institutions accredited by their regional accrediting association. Membership is held by the department, not by the individual.

Decade of Behavior  
750 First Street, N.E.  
Washington, DC 20002-4242  
Telephone: 202-336-6166  
[www.decadeofbehavior.org](http://www.decadeofbehavior.org)

The Decade of Behavior, launched in September 2000, is a multidisciplinary initiative to focus the talents, energy, and creativity of the behavioral and social sciences on meeting many of society's most significant challenges. These include improving education and health care; enhancing safety in homes and communities; actively addressing the needs of an aging population; and helping to curb drug abuse, crime, high-risk behaviors, poverty, racism, and cynicism toward government.

Federation of Behavioral, Psychological and Cognitive Sciences  
750 First Street, N.E.  
Washington, DC 20002  
Telephone: 202-336-5920  
<http://www.thefederationonline.org/>

The Federation of Behavioral, Psychological and Cognitive Sciences is a dues-supported coalition of member organizations, university departments of psychology, schools of education, research centers, regional psychological associations, and science divisions of the American Psychological Association. The federation represents the interests of scientists who do research in the areas of behavioral, psychological, and cognitive sciences. The efforts of the federation are focused on legislative and regulatory advocacy, education, and the communication of information to scientists.

Gerontological Society of America  
1030 15th Street, N.W., Suite 250  
Washington, DC 20005  
Telephone: 202-842-1275  
<http://www.geron.org/>

The Gerontological Society of America (GSA) is a nonprofit professional organization with more than 5,000 members in the field of aging. GSA provides researchers, educators, practitioners, and policymakers with opportunities to understand, advance, integrate, and use basic and applied research on aging to improve the quality of life as one ages.

Healthfinder  
P.O. Box 1133  
Washington, DC 20013-1133  
[www.healthfinder.gov/](http://www.healthfinder.gov/)

Healthfinder is a guide to reliable health information from the Department of Health and Human Services. The guide includes a health library of hand-picked health information from A to Z—prevention and wellness, diseases and conditions, and alternative medicine—plus medical dictionaries, an encyclopedia, journals, and more.

Health Psychology, Division 38 of the American Psychological Association  
750 First Street, N.E.  
Washington, DC 20002-4242  
Telephone: 202-336-6013  
[www.apa.org/about/division/div38.html](http://www.apa.org/about/division/div38.html)

Division 38 seeks to advance contributions of psychology to the understanding of health and illness through basic and clinical research, education, and service activities and encourages the integration of biomedical information about health and illness with current psychological knowledge. The division has a nursing and health group and special interest groups in aging, women, and minority health issues. The division publishes the bimonthly journal *Health Psychology* and the quarterly newsletter *Health Psychologist*. Division 38 offers a listing of training programs in health psychology and presents an annual student paper award.

Human Factors and Ergonomics Society  
P.O. Box 1369  
Santa Monica, CA 90406-1369  
Telephone: 310-394-2410  
<http://www.hfes.org/>

The mission of the Human Factors and Ergonomics Society is to promote the discovery and exchange of knowledge concerning the characteristics of human beings that are applicable to the design of systems and devices of all kinds. The society was founded in 1957 as the Human Factors Society of America. Later, the name was changed to the Human Factors Society, Inc., to reflect its international influence and membership. In 1992, the name was changed to the Human Factors and Ergonomics Society.

Institute for the Advancement of Human Behavior  
4370 Alpine Road, Suite 209

Portola Valley, CA 94028  
Telephone: 1-800-258-8411  
[www.iahb.org](http://www.iahb.org)

The Institute for the Advancement of Human Behavior (IAHB) is a fully accredited sponsor of continuing education and continuing medical education for mental health, chemical dependency, and substance abuse treatment providers in the United States and Canada. IAHB's mission is to provide high-quality clinical training to health care professionals as well as to companies and individuals with health care-related interests.

Institute for the Advancement of Social Work Research  
750 First Street, N.E., Suite 700  
Washington, DC 20002-4241  
Telephone: 202-336-8385  
<http://www.iaswresearch.org/>

The Institute for the Advancement of Social Work Research (IASWR) is a Washington, D.C.-based non-profit organization. IASWR works to improve the lives of vulnerable populations by advocating for the importance of research to strengthen the social work profession's capacity to address complex social needs, and to contribute to improved prevention and treatment interventions, services, and policies. The overarching, single mission of IASWR is to promote and strengthen research in the social work profession.

Institute of Medicine  
The National Academies  
500 Fifth Street, N.W.  
Washington, DC 20001  
Telephone: 202-334-2138  
[www.iom.edu/](http://www.iom.edu/)

The mission of the Institute of Medicine (IOM) is to advance and disseminate scientific knowledge to improve human health. The institute provides objective, timely, authoritative information and advice concerning health and science policy to government, the corporate sector, the professions, and the public. IOM is part of the National Academy of Sciences organizations and does not receive direct federal appropriations for its work. The National Academy of Sciences was created by the federal government to be an adviser on scientific and technological matters.

Intercultural Cancer Council  
6655 Travis, Suite 322  
Houston, TX 77030-1312

Telephone: 713-798-4617  
<http://iccnetwork.org>

The Intercultural Cancer Council (ICC) promotes policies, programs, partnerships, and research to eliminate the unequal burden of cancer among racial and ethnic minorities and medically underserved populations in the United States and its associated territories.

International Psycho-Oncology Society  
2365 Hunters Way  
Charlottesville, VA 22911  
Telephone: 434-971-4788  
<http://www.ipos-society.org>

The International Psycho-Oncology Society (IPOS) was created to foster international multidisciplinary communication about clinical, educational, and research issues that relate to the subspecialty of psycho-oncology. The society seeks to provide leadership and development of standards for educational training and research in the two psychosocial dimensions of cancer: the response of patients, families, and staff to cancer and its treatment at all stages, and the psychological, social, and behavioral factors that influence tumor progression and survival. It has boundaries with all clinical oncologic specialties, epidemiology and cancer control, basic sciences, bioethics, palliative care, rehabilitation, clinical trials, and decision making.

International Social Science Council  
UNESCO House  
1, rue Miollis  
75732 Paris Cedex 15, France  
<http://www.unesco.org/ngo/issc/sommaire.htm>

The International Social Science Council (ISSC) is an international nonprofit scientific organization with its headquarters in UNESCO House in Paris. The ISSC has as its aims and objectives the promotion of the understanding of human society in its environment by fostering the social and behavioral sciences throughout the world and their application to major contemporary problems and by enhancing cooperation by means of a global international organization of social and behavioral scientists and social and behavioral science organizations, encouraging multidisciplinary and interdisciplinary cooperation among the members of the ISSC.

International Society for Developmental Psychobiology  
<http://www.oswego.edu/isdp/>

The purposes of the International Society for Developmental Psychobiology are to (a) promote and encourage research on the development of behavior in all organisms including humans, with special attention to the effects of biological factors operating at any level of organization; (b) facilitate communication of research results and theory in the area of developmental psychobiology through the use of both professional and popular printed media and through the presentation of papers at meetings of the society; and (c) foster application of the valid findings of research to human affairs in a way beneficial to humankind.

International Society of Behavioral Medicine  
[www.isbm.miami.edu](http://www.isbm.miami.edu)

The International Society of Behavioral Medicine (ISBM) is a federation of national societies whose goal is to serve the needs of all health-related disciplines concerned with issues relevant to behavioral medicine. Each national society includes both biomedical and behavioral scientists.

MEDLINEplus  
<http://medlineplus.gov/>

MEDLINEplus is a Web site with authoritative consumer health information from the National Institutes of Health and others.

MEDLINE/PubMed  
[www.ncbi.nih.gov/entrez/query.fcgi](http://www.ncbi.nih.gov/entrez/query.fcgi)

MEDLINE/PubMed is a database with references, primarily from MEDLINE, to journal articles in life sciences with a concentration on articles in the biomedical field.

The Metanexus Institute  
3624 Market Street, Suite 301  
Philadelphia, PA 19104  
Telephone: 215-789-2200  
[www.metanexus.net](http://www.metanexus.net)

The Metanexus Institute advances research, education, and outreach on the constructive engagement of science and religion. It seeks to create an enduring intellectual and social movement by collaborating with persons and communities from diverse religious traditions and scientific disciplines.

National Academy of Neuropsychology  
2121 South Oneida Street, Suite 550  
Denver, CO 80224-2594

Telephone: 303-691-3694  
<http://www.nanonline.org/>

The National Academy of Neuropsychology is a professional society that includes clinicians, scientist practitioners, and researchers interested in neuropsychology.

National Academy of Sciences  
500 Fifth Street, N.W.  
Washington, DC 20001  
Telephone: 202-334-2000  
<http://www4.nationalacademies.org/nas/nashome.nsf>

The National Academy of Sciences (NAS) is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. The academy is governed by a council composed of 12 members (councilors) and five officers, elected from among the academy membership. The council is responsible to the membership for the activities undertaken by the organization and for the corporate management of the National Academy of Sciences, a corporation created by act of Congress that also includes the National Academy of Engineering (NAE), the Institute of Medicine (IOM), and the National Research Council (NRC). Collectively, these organizations are called the National Academies.

National Cancer Institute  
6116 Executive Boulevard, MSC 8322  
Bethesda, MD 20892-8322  
Telephone: 1-800-422-6237  
[www.nci.nih.gov/](http://www.nci.nih.gov/)

The National Cancer Institute (NCI) leads a national effort to reduce the burden of cancer morbidity and mortality. Its goal is to stimulate and support scientific discovery and its application to achieve a future when all cancers are uncommon and easily treated. Through basic and clinical biomedical research and training, NCI conducts and supports programs to understand the causes of cancer; prevent, detect, diagnose, treat, and control cancer; and disseminate information to the practitioner, patient, and public.

National Center for Complementary and Alternative Medicine  
Bethesda, MD 20892  
Telephone: 1-888-644-6226  
[www.nccam.nih.gov/](http://www.nccam.nih.gov/)

The National Center for Complementary and Alternative Medicine (NCCAM) is dedicated to exploring complementary and alternative medical (CAM) practices in the context of rigorous science, training CAM researchers, and disseminating authoritative information.

National Center for Research Resources  
One Democracy Plaza, Room 984  
6701 Democracy Boulevard, MSC 4874  
Bethesda, MD 20892-4874  
Telephone: 301-435-0888  
[www.ncrr.nih.gov/](http://www.ncrr.nih.gov/)

The National Center for Research Resources (NCRR) advances biomedical research and improves human health through research projects and shared resources that create, develop, and provide a comprehensive range of human, animal, technological, and other resources. NCRR's support is concentrated in four areas: biomedical technology, clinical research, comparative medicine, and research infrastructure.

National Center on Minority Health and Health Disparities  
6707 Democracy Boulevard, Suite 800, MSC 5465  
Bethesda, MD 20892-5465  
Telephone: 301-402-1366  
[www.ncmhd.nih.gov/](http://www.ncmhd.nih.gov/)

The mission of the National Center on Minority Health and Health Disparities (NCMHD) is to promote minority health and to lead, coordinate, support, and assess the National Institutes of Health effort to reduce and ultimately eliminate health disparities. In this effort, NCMHD will conduct and support basic, clinical, social, and behavioral research; promote research infrastructure and training; foster emerging programs; disseminate information; and reach out to minority and other health disparity communities.

National Heart, Lung, and Blood Institute  
Bethesda, MD 20892  
Telephone: 301-592-8573  
[www.nhlbi.nih.gov/](http://www.nhlbi.nih.gov/)

The National Heart, Lung, and Blood Institute (NHLBI) provides leadership for a national program in diseases of the heart, blood vessels, lung, and blood; blood resources; and sleep disorders. NHLBI plans, conducts, fosters, and supports an integrated and coordinated program of basic research, clinical investigations and trials, observational studies, and demonstration and education projects.

National Human Genome Research Institute  
[www.nhgri.nih.gov/](http://www.nhgri.nih.gov/)

The National Human Genome Research Institute (NHGRI) supports the National Institutes of Health component of the Human Genome Project, a worldwide research effort designed to analyze the structure of human DNA and determine the location of the estimated 30,000 to 40,000 human genes.

National League for Nursing  
61 Broadway  
New York, NY 10006  
Telephone: 1-800-669-1656 or 212-363-5555  
<http://www.nln.org/>

The National League for Nursing advances quality nursing education that prepares the nursing workforce to meet the needs of diverse populations in an ever-changing health care environment.

National Institute of Allergy and Infectious Diseases  
Building 31, Room 7A-50, MSC 2520  
31 Center Drive  
Bethesda, MD 20892-2520  
[www.niaid.nih.gov/](http://www.niaid.nih.gov/)

National Institute of Allergy and Infectious Diseases (NIAID) research strives to understand, treat, and ultimately prevent the myriad infectious, immunologic, and allergic diseases that threaten millions of human lives.

National Institute of Arthritis and  
Musculoskeletal and Skin Diseases  
1 AMS Circle  
Bethesda, MD 20892-3675  
Telephone: 301-495-4484  
[www.niams.nih.gov/](http://www.niams.nih.gov/)

The National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) supports research into the causes, treatment, and prevention of arthritis and musculoskeletal and skin diseases, the training of basic and clinical scientists to carry out this research, and the dissemination of information on research progress in these diseases.

National Institute of Child Health and Human  
Development  
Building 31, Room 2A32, MSC 2425  
31 Center Drive  
Bethesda, MD 20892-2425  
[www.nichd.nih.gov/](http://www.nichd.nih.gov/)

National Institute of Child Health and Human Development (NICHD) research on fertility, pregnancy, growth, development, and medical rehabilitation strives to ensure that every child is born healthy and wanted and grows up free from disease and disability.

National Institute of Dental and Craniofacial Research  
Bethesda, MD 20892-2190  
Telephone: 301-496-4261  
[www.nidcr.nih.gov/](http://www.nidcr.nih.gov/)

The National Institute of Dental and Craniofacial Research (NIDCR) provides leadership for a national research program designed to understand, treat, and ultimately prevent the infectious and inherited craniofacial-oral-dental diseases and disorders that compromise millions of human lives.

National Institute of Diabetes and Digestive and Kidney Diseases  
Building 31, Room 9A04, MSC 2560  
Center Drive  
Bethesda, MD 20892  
[www.niddk.nih.gov/](http://www.niddk.nih.gov/)

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) conducts and supports basic and applied research and provides leadership for a national program in diabetes, endocrinology, and metabolic diseases; digestive diseases and nutrition; and kidney, urologic, and hematologic diseases. Several of these diseases are among the leading causes of disability and death; all seriously affect the quality of life of those who have them.

National Institutes of Health  
9000 Rockville Pike  
Bethesda, MD 20892  
[www.nih.gov/](http://www.nih.gov/)

The National Institutes of Health (NIH) is the steward of medical and behavioral research for the United States. Its mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. The goals of the agency are as follows: (1) foster fundamental creative discoveries, innovative research strategies, and their applications as a basis to advance significantly the nation's capacity to protect and improve health; (2) develop, maintain, and renew scientific human and physical resources that will assure the nation's capability to prevent disease;

(3) expand the knowledge base in medical and associated sciences in order to enhance the nation's economic well-being and ensure a continued high return on the public investment in research; and (4) exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

National Institute of Mental Health  
6001 Executive Boulevard, Room 8184, MSC 9663  
Bethesda, MD 20892  
Telephone: 301-443-4513  
[www.nimh.nih.gov/](http://www.nimh.nih.gov/)

The National Institute of Mental Health (NIMH) provides national leadership dedicated to understanding, treating, and preventing mental illnesses through basic research on the brain and behavior, and through clinical, epidemiological, and services research.

National Institute of Neurological Disorders and Stroke  
P.O. Box 5801  
Bethesda, MD 20824  
Telephone: 1-800-352-9424  
[www.ninds.nih.gov/](http://www.ninds.nih.gov/)

The mission of the National Institute of Neurological Disorders and Stroke (NINDS) is to reduce the burden of neurological diseases—a burden borne by every age group, every segment of society, and people all over the world. To accomplish this goal, the NINDS supports and conducts research, both basic and clinical, on the normal and diseased nervous system, fosters the training of investigators in the basic and clinical neurosciences, and seeks better understanding, diagnosis, treatment, and prevention of neurological disorders.

National Institute of Nursing Research  
[www.ninr.nih.gov/](http://www.ninr.nih.gov/)

The National Institute of Nursing Research (NINR) supports clinical and basic research to establish a scientific basis for the care of individuals across the life span—from the management of patients during illness and recovery to the reduction of risks for disease and disability; the promotion of healthy lifestyles; the promotion of quality of life in those with chronic illness; and the care for individuals at the end of life. This research may also include families within a community context, and it also focuses on the special needs of at-risk and underserved populations, with an emphasis on health disparities.

National Institute on Aging  
Building 31, Room 5C27, MSC 2292  
31 Center Drive  
Bethesda, MD 20892  
Telephone: 301-496-1752  
[www.nia.nih.gov/](http://www.nia.nih.gov/)

The National Institute on Aging (NIA) leads a national program of research on the biomedical, social, and behavioral aspects of the aging process; the prevention of age-related diseases and disabilities; and the promotion of a better quality of life for all older Americans.

National Institute on Alcohol Abuse and Alcoholism  
6000 Executive Boulevard, Willco Building  
Bethesda, MD 20892-7003  
[www.niaaa.nih.gov/](http://www.niaaa.nih.gov/)

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) conducts research focused on improving the treatment and prevention of alcoholism and alcohol-related problems to reduce the enormous health, social, and economic consequences of this disease.

National Institute on Deafness and  
Other Communication Disorders  
MSC 2320  
31 Center Drive  
Bethesda, MD 20892-2320  
[www.nidcd.nih.gov/](http://www.nidcd.nih.gov/)

The National Institute on Deafness and Other Communication Disorders (NIDCD) conducts and supports biomedical research and research training on normal mechanisms as well as diseases and disorders of hearing, balance, smell, taste, voice, speech, and language that affect 46 million Americans.

National Institute on Drug Abuse  
[www.nida.nih.gov/](http://www.nida.nih.gov/)

The National Institute on Drug Abuse (NIDA) leads the nation in bringing the power of science to bear on drug abuse and addiction through support and conduct of research across a broad range of disciplines and rapid and effective dissemination of results of that research to improve drug abuse and addiction prevention, treatment, and policy.

National Library of Medicine  
8600 Rockville Pike  
Bethesda, MD 20894  
[www.nlm.nih.gov/](http://www.nlm.nih.gov/)

The National Library of Medicine (NLM) collects, organizes, and makes available biomedical science information to investigators, educators, and practitioners and carries out programs designed to strengthen medical library services in the United States. Both health professionals and the public use its electronic databases, including MEDLINE and MEDLINEplus, extensively throughout the world.

National Science Foundation  
4201 Wilson Boulevard  
Arlington, VA 22230  
Telephone: 703-292-5111  
[www.nsf.gov](http://www.nsf.gov)

The National Science Foundation (NSF) is an independent agency of the U.S. government. The NSF's mission is to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

Neurobehavioral Teratology Society  
<http://www.nbts.org/>

The purpose of the Neurobehavioral Teratology Society (NBTS) is to understand the behavioral and developmental alterations that result from genetic and environmental perturbations of the nervous system during the pre- and perinatal period. NBTS is also focused on communicating such findings to physicians, scientists, public health officials, and the general public to promote awareness and lessen the risks for teratologic occurrences in the population at large. NBTS also has a special focus of educating scientists in the appropriate methodology for conducting teratologic research.

Office of Behavioral and Social Sciences Research  
<http://obssr.od.nih.gov/>

The Office of Behavioral and Social Sciences Research (OBSSR) mission is to stimulate behavioral and social sciences research throughout the National Institutes of Health (NIH) and to integrate these areas of research more fully into others of the NIH health research enterprise, thereby improving our understanding, treatment, and prevention of disease.

Office of Disease Prevention and Health Promotion  
200 Independence Avenue S.W., Room 738G  
Washington, DC 20201  
Telephone: 202-205-8611  
[www.odphp.osophs.dhhs.gov/](http://www.odphp.osophs.dhhs.gov/)

Created by Congress in 1976, the Office of Disease Prevention and Health Promotion (ODPHP) plays a vital role in developing and coordinating a wide range of national disease prevention and health promotion strategies.

Psychology.info  
<http://psychology.info/>

Psychology.info is the easiest starting point for psychology and mental health information on the Internet. The links are handpicked psychology destinations with reliable information and include recent headlines in the field of psychology.

PsychoNeuroImmunology Research Society  
6619 Palma Lane  
Morton Grove, IL 60053  
[www.pnirs.org](http://www.pnirs.org)

The PsychoNeuroImmunology Research Society (PNIRS) is an international organization for researchers in a number of scientific and medical disciplines, including psychology, neurosciences, immunology, pharmacology, psychiatry, behavioral medicine, infectious diseases, and rheumatology, who are interested in interactions between the nervous system and the immune system, and the relationship between behavior and health.

Psychonomic Society  
1710 Fortview Road  
Austin, TX 78704  
Telephone: 512-462-2442  
<http://www.psychonomic.org/>

The Psychonomic Society promotes the communication of scientific research in psychology and allied sciences. Its members are qualified to conduct and supervise scientific research, must hold a PhD degree or equivalent, and must have published significant research other than the doctoral dissertation.

Psych web  
[www.psywww.com/](http://www.psywww.com/)

Psych web is a Web site containing lots of psychology-related information for students and teachers of psychology.

Public Health Institute  
2001 Addison Street, Second Floor  
Berkeley, CA 94704-1103  
Telephone: 510-644-8200  
<http://www.phi.org/>

The Public Health Institute (PHI) is an independent, nonprofit organization dedicated to promoting health, well-being, and quality of life for people throughout California, across the nation, and around the world. As one of the largest and most comprehensive public health organizations in the nation, the PHI focuses its efforts in two distinct but complementary ways. PHI promotes and sustains independent, innovative research, training, and demonstration programs—many in collaboration with the private health care system and community-based organizations. PHI also serves as a partner with government to support its role in assessment, policy development, and assurance.

Research Society on Alcoholism  
4314 Medical Parkway, Suite 12  
Austin, TX 78756-3332  
Telephone: 512-454-0022  
<http://www.rsoa.org/>

The Research Society on Alcoholism (RSA) serves as a meeting ground for scientists in the broad areas of alcoholism and alcohol-related problems. The society promotes research and the acquisition and dissemination of scientific knowledge.

Robert Wood Johnson Foundation  
P.O. Box 2316  
Princeton, NJ 08543  
Telephone: 1-888-631-9989  
[www.rwjf.org](http://www.rwjf.org)

The Robert Wood Johnson Foundation is the largest philanthropy devoted exclusively to health and health care in the United States. The Robert Wood Johnson Foundation seeks to improve the health and health care of all Americans. To achieve the most impact with its funds, it prioritizes grants into four goal areas: to ensure that all Americans have access to quality health care at reasonable cost; to improve the quality of care and support for people with chronic health conditions; to promote healthy communities and lifestyles; and to reduce the personal, social, and economic harm caused by substance abuse—tobacco, alcohol, and illicit drugs.

Science.gov  
[www.science.gov](http://www.science.gov)

Science.gov is a gateway to authoritative selected science information provided by U.S. government agencies, including research and development results. It contains reliable information resources selected by



the respective agencies as their best science information. Two major types of information are included—selected authoritative science Web sites and databases of technical reports, journal articles, conference proceedings, and other published materials. The selected Web sites can be explored from the science.gov homepage. The Web pages and the databases can be searched individually or simultaneously from the search page.

Social Sciences Institute  
North Carolina AT&T University  
Charles H. Moore Building, A-35  
Greensboro, NC 27411  
[www.ssi.nrcs.usda.gov/ssi/](http://www.ssi.nrcs.usda.gov/ssi/)

The Social Sciences Institute (SSI) integrates customer opinion and fieldwork with science-based analysis to discover how social and economic aspects of human behavior can be applied to natural resource conservation programs, policies, and activities.

Society of Behavioral Medicine  
7600 Terrace Avenue, Suite 203  
Middleton, WI 53562  
Telephone: 608-827-7267  
[www.sbm.org](http://www.sbm.org)

The Society of Behavioral Medicine (SBM) is the nation's largest multidisciplinary organization dedicated to advancing the science and practice of behavioral medicine. Behavioral medicine is defined as an interdisciplinary field dedicated to improving individual and population health through the integration of scientific knowledge from the behavioral, biomedical, social, and public health disciplines and through the application of this evidence-based knowledge to improve prevention, treatment, rehabilitation, chronic illness management, quality of life, and coping during all phases of the life cycle.

Society for Behavioral Neuroendocrinology  
4327 Ridge Road  
Palmyra, VA 22963  
[www.sbn.org](http://www.sbn.org)

The Society for Behavioral Neuroendocrinology (SBN) is a scientific society committed to understanding interactions between behavior and neuroendocrine function to advance understanding of behavioral neuroendocrinology. The society promotes exchanges between investigators approaching this problem from diverse perspectives. Researchers working in

laboratory, field, or clinical settings and on invertebrates, vertebrates, or cell lines both in vitro and in vivo are encouraged to join the society. Scientists interested in behavioral ecology, animal behavior, biological timing, neurosciences, endocrinology, development, cell biology, and genetics are all welcome. One's research need not explicitly employ behavioral techniques as long as the research is relevant to behavior. Similarly, behavioral research need not employ neuroendocrine techniques, but only be related to neuroendocrine function. Integrating cellular and molecular concepts into a functional framework is crucial to understanding how neuroendocrine function affects behavior and is, in turn, affected by behavior.

Society for Medical Decision Making  
1211 Locust Street  
Philadelphia, PA 19107  
Telephone: 215-545-7697  
<http://www.smdm.org/>

The Society for Medical Decision Making's mission is to improve health outcomes through the advancement of proactive systematic approaches to clinical decision making and policy formation in health care by providing a scholarly forum that connects and educates researchers, providers, policymakers, and the public.

Society for Neuroscience  
11 Dupont Circle, N.W., Suite 500  
Washington, DC 20036  
Telephone: 202-462-6688  
[www.sfn.org](http://www.sfn.org)

The Society for Neuroscience (SfN) is a nonprofit membership organization of basic scientists and physicians who study the brain and nervous system. Neuroscience includes the study of brain development, sensation and perception, learning and memory, movement, sleep, stress, aging, and neurological and psychiatric disorders. It also includes the molecules, cells, and genes responsible for nervous system functioning.

Society of Pediatric Psychology  
P.O. Box 170231  
Atlanta, GA 30317  
[www.apa.org/divisions/div54/](http://www.apa.org/divisions/div54/)

The Society of Pediatric Psychology (SPP) provides a forum for scientists and professionals interested in the health care of children, adolescents, and

their families. The field of pediatric psychology is defined by the concerns of psychologists and allied professionals who work in interdisciplinary settings such as children's hospitals, developmental clinics, and pediatric or medical group practices, as well as traditional clinical child or academic arenas. It focuses on the rapidly expanding role of behavioral medicine and health psychology in the care of children, adolescents, and their families. As Division 54 of the American Psychological Association (APA), it provides an annual forum for research and practice presentations at the annual APA convention.

Society for Prevention Research  
1300 I Street, N.W., Suite 250 West  
Washington, DC 20005  
Telephone: 202-216-9670  
<http://info@preventionresearch.org>

One of the primary goals of the Society for Prevention Research (SPR) is to create a scientific, multidisciplinary forum for prevention science, and a concerted effort is being made to invite investigators whose research specialties are not represented in the current membership to join SPR.

Society for Psychophysiological Research  
1010 Vermont Avenue, N.W., Suite 1100  
Washington, DC 20005-4907  
Telephone: 202-393-4810  
[www.wlu.edu/~spr/](http://www.wlu.edu/~spr/)

The Society for Psychophysiological Research is an international scientific society with worldwide membership. The purpose of the society is to foster research on the interrelationships between the physiological and psychological aspects of behavior.

Society for Public Health Education  
750 First Street N.E., Suite 910  
Washington, DC 20002-4242  
Telephone: 202-408-9804  
<http://www.sophe.org/>

The Society for Public Health Education (SOPHE) is an independent, international professional association made up of a diverse membership of health education professionals and students. The society promotes healthy behaviors, healthy communities, and healthy environments through its membership, its network of local chapters, and its numerous partnerships with other organizations. With its primary focus on public health education, SOPHE provides leadership

through a code of ethics; standards for professional preparation, research, and practice; professional development; and public outreach.

Society for Research in Child Development  
University of Michigan  
3131 South State Street, Suite 302  
Ann Arbor, MI 48108-1623  
<http://www.srcd.org/>

The purposes of the Society for Research in Child Development are to promote multidisciplinary research in the field of human development, to foster the exchange of information among scientists and other professionals of various disciplines, and to encourage applications of research findings. The society is a multidisciplinary, not-for-profit, professional association with a membership of approximately 5,500 researchers, practitioners, and human development professionals from more than 50 countries.

Society for Research on Nicotine and Tobacco  
7600 Terrace Avenue, Suite 203  
Middleton, WI 53562, USA  
Telephone: 608-836-3787  
[www.srnt.org/](http://www.srnt.org/)

The mission of the Society for Research on Nicotine and Tobacco (SRNT) is to stimulate the generation of new knowledge concerning nicotine in all its manifestations—from molecular to societal.

Society for Stimulus Properties of Drugs  
<http://www.sspd.org.uk/>

The Society for Stimulus Properties of Drugs (SSPD) supports the use of drug discrimination methods and some related approaches in teaching and research on psychoactive drugs. Many of these drugs have medical uses in psychiatry and neurology, whereas others have no recognized medical uses but may be under development for such use, or are subject to abuse. Both licit and illicit substances are included. Membership of SSPD is open to individuals with bachelor or higher degrees in relevant subjects and with a genuine interest in the field.

Substance Abuse and Mental Health Services Agency  
5600 Fishers Lane  
Rockville, MD 20857  
[www.samhsa.gov/](http://www.samhsa.gov/)

The Substance Abuse and Mental Health Services Agency (SAMHSA) is the federal agency charged with improving the quality and availability of prevention, treatment, and rehabilitative services in order to reduce illness, death, disability, and cost to society resulting from substance abuse and mental illnesses.

U.S. National Committee of the International Union of Psychological Science  
<http://www.iupsys.org/>

The International Union of Psychological Science serves as an umbrella international voice supporting “the development of psychological science, whether biological or social, normal or abnormal, pure or applied.” It has national members from close to 70 countries, and works to represent the full breadth of psychology as a profession and as a science.

Women’s Health Initiative  
[www.nhlbi.nih.gov/whi/](http://www.nhlbi.nih.gov/whi/)  
[www.whi.org/](http://www.whi.org/)

The Women’s Health Initiative (WHI) is one of the largest preventive studies of its kind in the United States. The WHI is a 15-year research program that is composed of three major components: a randomized controlled clinical trial of promising but unproven approaches to prevention, an observational study to identify predictors of disease, and a study of community approaches to developing healthful behaviors.

World Health Organization  
Avenue Appia 20  
1211 Geneva 27, Switzerland  
Telephone: (+ 41 22) 791 21 11  
<http://www.who.int>

The World Health Organization (WHO), the United Nations specialized agency for health, was established in 1948. WHO’s mission is the attainment by all peoples of the highest possible level of health. Health is defined in WHO’s constitution as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

# Appendix B

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## 2

Editor in Chief  
NORMAN B. ANDERSON, PhD  
American Psychological Association

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## HAPPINESS AND HEALTH

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Although the relation between psychological processes and health (both mental and physical) is not new, historically there has been a preponderance of research on the negative side—how poor psychological functioning relates to negative health outcomes. Meanwhile, attention has only recently turned toward understanding the antecedents and consequences of positive states. This entry focuses on pleasant emotions and life satisfaction and discusses both mental health and physical health as they relate to subjective well-being.

### WHAT IS HAPPINESS?

Understanding the relation between health and happiness naturally raises the question “What is happiness?” Happiness can mean several different things. It can refer to people’s overall evaluation of their own lives, or it can refer to momentary feelings of pleasantness. Because of the multiplicity of meanings that happiness holds, researchers sometimes prefer to use the term *subjective well-being* (SWB), although happiness is sometimes used synonymously with SWB. SWB refers to a combination of life satisfaction, pleasant affect, and low negative affect. Life satisfaction is a global cognitive evaluation—how a person feels about his or her life as a whole—although there are specific domain satisfactions as well (e.g., satisfaction with one’s marriage). Emotions, on the other hand, specifically reflect on-line evaluations of ongoing events by the affect system. The combination of

emotions and life satisfaction is called *subjective well-being* because it emphasizes the individual’s own assessment of his or her own life—not the judgment of “experts.”

### MENTAL HEALTH AND SWB

Some mood states, such as depression, are by definition part of low SWB and ill mental health. After all, depression entails having negative moods and a negative evaluation of one’s life. However, mental health includes more than simply the absence of negative moods. In a landmark paper on mental health, Jahoda (1958) called for the inclusion of positive states in conceptions of mental well-being. In other words, to be mentally healthy means to have positive feelings as well as minimal negative feelings. As expected, individuals with a mental illness such as schizophrenia, personality disorder, or depression tend to be less satisfied with their lives and experience greater and more intense negative emotion and less positive emotion than nonclinical populations.

Does mental illness cause a decrease in life satisfaction? For some mental illnesses, the link to SWB is definitional—that is, depression is virtually the same as having low SWB. For other mental illnesses such as schizophrenia, there may be more of a causal link in that having schizophrenia leads to lower SWB. Even so, the causality is not necessarily direct because mental illness is often accompanied by poor social functioning and other problems in living, such as keeping a job, that in turn influence SWB. Medication can improve the SWB of schizophrenics, but again, these effects are complex. Medication can improve the

person's moods directly or improve daily functioning, both of which have an impact on SWB. Incidentally, some factors that may mitigate the sufferings of people with mental illness overlap with factors that influence the SWB of nonclinical populations—for example, having close social relationships. Schizophrenics who have a close friend are happier than those with no support network.

Diener and Seligman (2002) examined the relation between mental health and SWB from a different perspective by studying the happiest people. Compared to the very unhappy or moderately happy, not a single person who was identified as very happy scored in the clinical range on scales of psychopathology (e.g., depression, paranoia, schizophrenia), with the exception of some elevated mania scores among a few individuals. Thus, psychopathology seems incompatible with high happiness.

Other mental illnesses such as Alzheimer's disease and dementia are also associated with lower life satisfaction, although the degree depends on several other factors such as social support and level of functioning. Interestingly, the life satisfaction of caregivers of Alzheimer patients, senile family members, or those who had strokes also tends to be low. Caretakers' well-being depends in part on the amount of additional support received. Nevertheless, this suggests an important point—that it is more than one's own health that matters. The health of those around us, particularly close individuals, seems as important as our own health in influencing life satisfaction. These issues become paramount in the changing face of world demographics. The past 300 years has seen an increase in life expectancy, and with it an increase in the proportion of elderly in the population. By 2020, 16% of the U.S. population will be over 65, and by 2050, the average life expectancy for Americans will be 82.6 years. Clearly, longevity is a desirable aim, but research on the SWB of the elderly and their caretakers suggests a further need to consider other aspects of a long life, such as quality of life and level of functioning.

## PHYSICAL HEALTH AND SWB

### Two-Way Causal Direction

Although there are a variety of ways to examine the relation between physical health and SWB, most researchers and health professionals are interested in

determining causal influences. In other words, does happiness lead to better health or are healthy people happier? Unfortunately, the bulk of studies have relied on cross-sectional designs and correlational methods, which do not help us disentangle causal direction. Also, correlational studies are always susceptible to the problem of third variables such as personality factors influencing both the outcome and SWB. Despite these problems, data suggest causality in both directions.

### Bad Health Causing Lower SWB

Not surprisingly, bad health is negatively correlated with SWB. Studies of the elderly have shown that more chronic medical conditions are associated with lower life satisfaction. Brickman, Coates, and Janoff-Bulman's (1978) classic study of people with spinal cord injuries showed that, although the accident victims were not abjectly miserable for the rest of their lives, their SWB did decrease and remain lower than preaccident levels. However, as with mental illness, there may be mediational pathways linking health and SWB. For instance, health problems that prevent people from engaging in life's everyday activities or from caring for themselves (e.g., severe heart disease and chronic lung disease) have the greatest impact on lowering life satisfaction. In addition, the chronic fatigue often associated with some illnesses such as multiple sclerosis tends to lower life satisfaction. Studies of chronic pain sufferers such as people with arthritis, chronic headaches, or obesity show that beyond the immediate effects of pain, limitations on daily activities lower SWB.

The few longitudinal studies that exist provide greater insight into the direction of causality. One study of elderly people found that chronic health problems, functional impairment, and somatic complaints predicted lower life satisfaction 3 years later, while self-rated health and good vision were associated with higher life satisfaction. Among individuals with spinal cord injuries, those who attain employment show higher SWB over time, whereas those who are unemployed become less happy. In a 1-year follow-up of patients with chronic health conditions, those who had multiple health problems declined in SWB, while those with only one problem showed improvement after 1 year. In short, people who do not feel well or whose functioning is impaired are not likely to be happy, and more severe or more numerous problems make for even worse outcomes.

If poor health is associated with lower SWB, we might expect the opposite to be true—that good health has positive effects. Unfortunately, it is difficult to determine whether the effects of good and ill health are symmetrical even though we know that health correlates moderately with SWB, especially among the elderly. If good health is considered the default and taken for granted, then the effects of health might fade into the background when health is good, and only surface when health is bad. Clearly, more research is needed to disentangle the effects.

### The Issue of Coping/Adaptation

The impact of ill health on SWB is not always intuitive; people can and do often cope with health problems, although they almost always underestimate their ability to do so. For instance, people predict that their SWB will be dramatically lower if they are diagnosed with HIV, but their predictions tend to be worse than reality.

The relation between health and SWB is further complicated by people's expectations, in that some health problems are expected at a certain age. For example, one study found that elderly patients with cancer or chronic ailments did not differ from their healthy peers in terms of SWB. Thus, some illnesses might not produce lower SWB for some people at some points in life. Part of this is due to the strong influence of personality and considerable stability in SWB over time. Many studies now suggest that the best predictor of future SWB is past SWB, not objective life events. In other words, some individuals who endure health problems can still be relatively happy, while others with only minor or no health problems might be unhappy.

### Subjective Versus Objective Health

Thus far, we have addressed, "What is happiness?" but the corollary to this question, "What is health?" also warrants scrutiny. Health can be measured subjectively, in terms of people's self-reports of symptoms, or objectively, as the number of doctor visits and doctors' evaluations. This distinction is important because the relation between health and SWB is stronger for subjective health. For objective health measures, the relation is much weaker. This suggests a possible methodological confound in studies using subjective health: Happy people tend to perceive

themselves as healthier. However, even number of doctor visits can be influenced by personality by directing our attention (e.g., toward bodily sensations), perceptions (e.g., sensations interpreted as illness), and actions (e.g., seeking medical treatment). Also, doctors' evaluations are naturally influenced by what the patient reports. Highly negative individuals will be more apt to complain. Thus, even objective health measures can be influenced by a patient's happiness.

### Some Evidence Suggestive of Causality Going From SWB to Physical Health

The impact of SWB on health outcomes has been examined in four different ways: laboratory experiments, studies of naturally occurring mood, dispositional emotionality, and longitudinal studies.

*Immune function.* In laboratory experiments, researchers typically induce positive moods and measure the effects on physical markers of immune functioning (e.g., salivary immunoglobulin-A, natural killer cell activity). A consistent finding is that immune function increases after positive mood induction such as watching a humorous video. Similarly, studies of naturally occurring mood have found enhanced immune function on days when positive mood is greater than negative mood, or when positive events outweigh negative ones. When happiness is treated as a dispositional or trait-level construct, dispositionally happy people show better immune function.

Although positive emotion appears to have benefits on the immune system, the evidence is not entirely unequivocal. Some studies have shown that the effects of positive states on physical health are greatest within the context of negative emotions. For example, when humor is used as a coping device or when positive moods buffer negative moods, the effects are particularly salubrious. Similarly, individuals who are instructed to find benefits in a traumatic event often show improved health. Rather than feeling good all the time, healthy people appear to experience a wide range of emotions.

Finally, it is important to note that although low SWB might lead to bad health in terms of getting sick more often, it probably does not enter the causal chain of severe illnesses such as malaria or epilepsy. Happiness might have some additive effects on pre-existing conditions (e.g., making symptoms more or less

severe), but probably plays a minimal role in the etiology of serious diseases.

*Longevity.* As mentioned earlier, subjective health reports can be influenced by personality, thus making it difficult to disentangle the effects of SWB on health. However, one measure that is not confounded with subjective reporting is mortality. Although longitudinal research predicting longevity from SWB is still in its infancy, the existing studies suggest that happiness is associated with increased longevity. First, there is a direct effect in that low life satisfaction predicts an increased risk for suicide. Beyond suicide, however, happiness still predicts longevity. Danner, Snowden, and Friesen (2001) studied a group of nuns and found that the number of positive-emotion words used in autobiographical narratives written in their 20s predicted longevity six decades later. Nuns in the happiest quartile outlived those in the lowest quartile by 9.4 years. These results are particularly convincing because the researchers followed a homogeneous group that was similar in lifestyle. Longevity in this case was not likely confounded by the risky behaviors that often mediate the relationship between happiness and longevity. Similarly, a 2-year longitudinal study examining elderly Hispanics also found that positive emotionality predicted survival even after controlling for health behaviors.

*Health behaviors.* The relation between SWB and health can operate through health behaviors as well. For instance, happy people tend to pay more attention to health-related information, follow better diets, and exercise more. In addition, there is lower substance abuse among adolescents with high life satisfaction.

### Future Research

The past few decades of research on SWB and health have revealed significant and intriguing findings, but many more questions remain. The most definitive statement we can make at this point is that happiness is often associated with better health, but any causal conclusions remain tentative (but promising). Emerging evidence from experimental and longitudinal studies suggests that happiness might lead to better health, although we clearly need more studies of these kinds to tease apart the direction of effects. Meanwhile, third variables that cause both SWB and health continue to present a problem in determining causality.

Future research should examine more complex models of SWB and health, for example, the moderating effects of income and social support. Is the relation between SWB and health more pronounced among those with low income and low social support? Also, greater attention should be paid to separating the effects of positive emotion and negative emotion. Does pleasant affect suppress unpleasant affect? Often researchers measure only the negative (e.g., depression), despite evidence that the two have independent effects. Some evidence now suggests that positive affect has buffering effects on negative affect and that only positive—not negative—emotion leads to health benefits.

### GENERAL CONCLUSIONS

The field of SWB and health is an important area, although relatively new. From the research thus far, we can draw three main conclusions: (1) High SWB is inversely related to mental illness; (2) some physical illnesses are associated with lower SWB, but this relation is qualified by functional impairment, personality, and age expectancies; and (3) high SWB is sometimes associated with health benefits. The most compelling evidence is that positive emotion can lead to enhanced immune function, and possibly longevity. However, the data are far from definitive at this point, and many more experimental and longitudinal studies are needed to further disentangle the direction of causality.

—Ed Diener and Christie Napa Scollon

See also EMOTIONS: POSITIVE EMOTIONS AND HEALTH

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## HARDINESS AND HEALTH

Hardiness is a set of attitudes and skills that promote resiliency under stressful circumstances by enhancing performance, leadership, morale, and health (e.g., Maddi, 2002). The *HardiAttitudes*<sup>®</sup> are the 3Cs of commitment, control, and challenge (Maddi & Kobasa, 1984). Commitment is the conviction that staying involved with people and events, rather than pulling back, is the way to find meaning and value in your life. Control is the inclination to try to influence what is going on around you, rather than sink into powerlessness. Challenge is the belief that, as life is continually changing, you are most fulfilled by continuing to learn from your experiences, whether they are positive or negative, rather than by expecting easy comfort and security. In short, the *HardiAttitudes* provide the existential courage and motivation to work on transforming stressful circumstances from potential disasters into opportunities instead (Maddi, 2002). This transformation is accomplished through the *HardiSkills*<sup>®</sup> (Khoshaba & Maddi, 2001). These skills are for transformational coping (solving problems, rather than denying or avoiding them), activist social support (giving and getting assistance and encouragement, rather than overprotection or competition), and self-care (relaxation, nutrition, and exercise regimens leading to the moderate arousal that facilitates coping and social support efforts). As the rate of change mounts in our world, the combination of attitudes and skills constituting hardiness is all the more important in preserving and enhancing health and performance.

Hardiness was discovered through a longitudinal study of 450 male and female managers at Illinois Bell Telephone (IBT), from 1975 through 1986, that was designed to precede and follow the federal deregulation of the AT&T monopoly in 1981, so as to make way for a competitive telecommunications industry (Maddi & Kobasa, 1984). Throughout the study, the managers were tested in various psychological and medical ways each year. Still regarded as the largest upheaval in corporate history, the 1981 deregulation led to major downsizing and disruption at IBT.

Indeed, two thirds of the managers in the sample showed marked decreases in health and performance. In contrast, however, the other third not only survived but actually thrived on the upheaval. A determination of how this third of the sample differed from the other two thirds, in the years preceding the deregulation, disclosed the importance of *HardiAttitudes* and *HardiSkills* in resilient, as opposed to vulnerable, responses.

Since that time, considerable research on hardiness has been done all around the world. Initial measurement issues concerning an early form of the *HardiAttitudes* measure have been resolved successfully (Maddi, 1997). Early conceptual issues as to whether *HardiAttitudes* are anything more than the opposite of negative affectivity or neuroticism have also been successfully resolved (Maddi, 2002). A recent study (Sinclair & Tetrick, 2000) shows that the subscales of commitment, control, and challenge are, as hypothesized, nested under a second-order factor of *HardiAttitudes* and that this factor is not redundant with negative affectivity.

Ongoing research on the effects of *HardiAttitudes* has confirmed that they maintain and enhance health and performance under stressful circumstances. In a wide range of stressful contexts, ranging from life-threatening events of military combat, through the culture shock of immigration or work missions abroad, to everyday work or school pressures and demands, the buffering effect of hardiness is shown in decreasing mental and physical illness symptoms, whether these be self-reported or more objectively measured (cf. Maddi, 2002).

Furthermore, research shows that hardiness leads to better performance under stress (cf. Maddi, 2002). Examples are the positive relationship between *HardiAttitudes* and subsequent (1) basketball performance among varsity players, (2) success rates in officer training school for the Israeli military, (3) leadership behavior among West Point military cadets, (4) retention rate among college students, and (5) speed of recovery of baseline functioning following disruptive culture shock.

There is also research supporting the construct validity of *HardiAttitudes* (cf. Maddi, 2002). In an experiential sampling study in which participants were paged at random to comment on their ongoing activities, there was a positive relationship between *HardiAttitudes* and (1) involvement with others and events (commitment), (2) the sense that the activities

had been chosen and were influenceable (control), and (3) the positive process of learning from what was going on (challenge). Other findings are consistent with the hypothesis that the mechanism whereby the *HardiAttitudes* lead to beneficial health and performance effects is by providing the courage and motivation for enacting the *HardiSkills*. For example, results show that *HardiAttitudes* are related to the tendency to view life events as less stressful, cope transformationally with these events, avoid excessive physiological arousal, and pursue positive while avoiding negative health practices.

By now, there are hardiness assessment and training techniques useful not only in research but in practice as well. The latest and best *HardiAttitudes* measure is the *Personal Views Survey III-R* (Maddi & Khoshaba, 2001b), an 18-item rating scale questionnaire with adequate reliability and validity. The *HardiSurvey III-R*® (Maddi & Khoshaba, 2001a) is a 65-item rating scale questionnaire, also with adequate reliability and validity, which measures not only *HardiAttitudes* but also stress, strain, and *HardiSkills*. This test generates a comprehensive report comparing the person's stress vulnerability and stress resistance. Both tests can be administered on the Internet, or in hard copy form.

*HardiTraining*® is workbook based and involves the trainee in performing exercises that implement the *HardiSkills* in dealing with stressful circumstances and use the feedback thus obtained to deepen the *HardiAttitudes* (Khoshaba & Maddi, 2001). Workbooks are available for adults and for adolescents. One common training format involves several weekly sessions for small groups meeting with a trainer. Also common is an individual format, wherein the person works through the exercises alone, but checks in with a trainer at regular intervals. There is enough flexibility in the approach to permit other training formats as well. There is by now research evidence of the effectiveness of *HardiTraining* for both working adults and college students.

—Salvatore R. Maddi and Deborah M. Khoshaba

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## HARVARD ALUMNI HEALTH STUDY

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The Harvard Alumni Health Study is an ongoing epidemiological study of 36,000 men who matriculated at Harvard University as undergraduates between 1916 and 1950 (no women were admitted during those years). The study was established in the 1960s, when health questionnaires were sent to surviving alumni of these classes. The initial questionnaires, which collected information on sociodemographic characteristics, health habits, and personal and family medical history, were mailed in 1962 or 1966. Follow-up questionnaires collected updated information in 1972, 1977, 1988, 1993, and 1998. The study also obtained information from university archives from a standardized medical anamnesis and physical examination that the men underwent at the time of their entry into Harvard.

These Harvard men were chosen for study for several reasons. First, investigators had hoped to establish a study in which subjects could be followed for many years. For valid results to be obtained from the study, it is crucial that losses to follow-up be minimal. Preliminary work in the 1950s had indicated that the alumni office at Harvard University kept careful records on the whereabouts of students who had graduated, and subsequent research over the years has shown that this continues to be the case.

Second, to conduct a large study at low cost, investigators wanted to collect information by mail and presumed that alumni from an established university



would be well educated and interested in their health and thereby able to provide accurate health information on questionnaires. Validation studies subsequently conducted (e.g., that compared alumni self-reports of chronic diseases with their physicians' records) have proved this assumption correct. Finally, at the start of the study in 1962, the investigators could take advantage of information from the standardized medical anamnesis and physical examination done 12 to 46 years previously. This afforded them the opportunity to explore host and environmental data, recorded years in advance of the clinical onset of disease (such as coronary heart disease), as predictors of disease.

The main aims of the Harvard Alumni Health Study were and continue to be to investigate the health effects associated with a physically active way of life. Although the health benefits of physical activity have been extolled since antiquity (e.g., Hippocrates believed that lack of exercise was detrimental to health), this topic had received little scientific study before the 1960s, when the Harvard Alumni Health Study was initiated. In fact, the prevailing belief was that exercise might be harmful. Paul Dudley White (1886-1973), an eminent cardiologist at that time and one of the doctors who attended to President Eisenhower during his heart attack in 1955, was often belittled because he both believed in and practiced a physically active way of life.

Data from the Harvard Alumni Health Study and other studies of physical activity have played a crucial role in changing society's attitude toward physical activity. In the remainder of this entry, we will outline some of the key findings from the Harvard Alumni Health Study regarding the health benefits associated with physical activity.

Beginning in 1966, a series of publications has examined the role of physical activity in preventing coronary heart disease among Harvard alumni. Data from the Harvard Alumni Health Study show that there is a graded, inverse relation between levels of physical activity and rates of coronary heart disease. Men expending 1,000 to 1,999 kilocalories per week in physical activity had rates of coronary heart disease that were about one fifth lower than rates among men who expended less energy. With higher levels of energy expenditure, rates of coronary heart disease declined further.

Activities that were beneficial were those that were at least moderately vigorous in intensity (e.g., brisk walking, jogging or running, swimming laps, playing

tennis, shoveling snow). For men to experience lower rates of heart disease, they had to be presently performing these activities. That is, alumni who had been physically active during their college days but who were sedentary during middle age or later did not fare any better than their counterparts who had been sedentary during both times. However, those who had been sedentary during college but who took up physical activity during middle age or later experienced rates of coronary heart disease similar to those of men who had been active during both times. Even more encouraging, these data show that it is never too late to change: The benefits of taking up a physically active way of life were seen among men in their 40s all the way to those in their 80s.

These data, along with those from other studies, were used as the basis for formulation in 1995 of a new physical activity recommendation for the United States. This recommendation calls for at least 30 minutes of moderate intensity physical activity, such as brisk walking, most days of the week, a level that will generate about 1,000 kilocalories per week. The key role that the Harvard Alumni Health Study has played in elucidating the relation between physical activity and heart disease was acknowledged in 1996 with the joint award of the first International Olympic Committee Medal for work emanating from the Harvard Alumni Health Study, as well as research conducted among British civil servants.

The Harvard Alumni Health Study also examined the relation of physical activity to rates of stroke. As with coronary heart disease, data from the study showed that rates of stroke were lower in physically active men than in less active men. Men who expended 1,000 to 1,999 kilocalories per week had rates of stroke that were about one fourth lower than the rates of stroke among men who expended less than 1,000 kcal/week, and the rate among men who expended 2,000 to 2,999 kilocalories per week was about one half lower than the rate among men who expended less than 1,000 kcal/week. As with coronary heart disease, the activity carried out had to be at least moderately vigorous in intensity to be associated with lower rates of disease.

Because cardiovascular disease is the leading cause of death in men in the United States, preventing coronary heart disease and stroke would be expected to delay premature mortality. The Harvard Alumni Health Study has investigated whether physical activity is associated with increased longevity and

was among the earliest studies that attempted to quantify the number of years added. It was estimated that among men aged 35 to 79 years, those who expended at least 2,000 kilocalories per week would enjoy more than 2 years of added life (to age 80) as compared with those who expended less than 500 kilocalories per week.

Beginning in the 1990s, the study expanded its focus to include detailed investigations of the association of physical activity with various cancers. The study observed that physical activity also was associated with lower rates of certain cancers. Men who expended at least 1,000 kilocalories per week in physical activity experienced about half the colon cancer rates of men who were more sedentary. Higher levels of physical activity did not appear to further decrease rates of colon cancer. For lung cancer, there was a graded inverse relation between levels of physical activity and rates of this cancer, after accounting for the effects of cigarette smoking. On the other hand, there was little evidence that physical activity influenced the risk of developing prostate cancer or rectal cancer. Meanwhile, in a parallel study of women alumni from the University of Pennsylvania, physical activity was seen to be associated with lower rates of breast cancer in postmenopausal women.

In addition to the findings described above, data from the Harvard Alumni Health Study, as well as the parallel study of alumni from the University of Pennsylvania, have shown that a physically active way of life is associated with many other health benefits, including lower rates of hypertension, diabetes, and depression. These studies clearly show that physical activity is beneficial for health and that a sedentary way of life is detrimental with regard to many chronic diseases, carrying with it an increase in risk similar in magnitude to that seen with other well-established risk factors, such as cigarette smoking, being overweight, or having high blood pressure.

—I-Min Lee and Ralph S. Paffenbarger Jr.

See also CANCER AND PHYSICAL ACTIVITY; HEART DISEASE AND PHYSICAL ACTIVITY; PHYSICAL ACTIVITY AND HEALTH

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## HEADACHES: PSYCHOLOGICAL MANAGEMENT

### EPIDEMIOLOGY

Recurrent headaches are prevalent and are associated with substantial individual and societal burden. Approximately 18% of women and 6% of men (e.g., 28 million individuals in the United States; Lipton, Hamelsky, & Stewart, 2001) experience migraine. Approximately 36% of women and 42% of men experienced a tension-type headache in the past year, with 2.8% of women and 1.4% of men experiencing tension-type headaches more than 15 days per month.

Missed workdays and impaired work function resulting from migraine cost employers about \$13 billion a year, and direct medical costs run about \$1 billion per year. Because tension-type headaches are more prevalent than migraine, they are associated with greater societal costs even though they are associated with less individual disability. As the frequency or severity of either migraine or tension-type headaches increases, the impact of headaches on functioning increases. Consequently, a relatively small portion (< 50%) of individuals with frequent or severe headaches account for over 80% of the disability and costs associated with these disorders (Lipton et al., 2001).

### DIAGNOSIS

The International Headache Society (IHS; Olesen, 1988) classification system for headache disorders employs operational diagnostic criteria modeled after those in the *Diagnostic and Statistical Manual of*

*Mental Disorders* of the American Psychiatric Association. Primary headache disorders are distinguished from secondary headaches that result from an underlying disease. The two most prevalent primary headache disorders—migraine and tension-type headache—are of great interest in behavioral medicine. Diagnostic criteria are currently under revision, and a draft of these revised diagnostic criteria is available on the IHS Web site ([www.i-h-s.org](http://www.i-h-s.org)). Of course, the possibility of a secondary cause for headaches must be ruled out by physical and neurological exams and indicated tests before a diagnosis of a primary headache disorder can be made.

## PATHOPHYSIOLOGY

### Migraine

Migraine is primarily a neuronal disorder (Goadsby, Lipton, & Ferrari, 2002). Imaging studies showing the activation of brain stem regions involved in the control of sensory, nociceptive (pain), and vascular functions during spontaneous migraine provide support for the existence of a brain stem “migraine generator.” The sensory disturbances or “aura” that can precede migraine are believed to result from a “spreading depression,” or a transient inhibition of neuronal activity, that passes over the cerebral cortex. Pain and other phenomena of migraine are thought to result from activation of trigeminal innervation of the vasculature; it is unclear if it is the spreading depression that induces trigeminal activation or if spreading depression is simply a parallel phenomenon (Goadsby et al., 2002). Nonetheless, activation of trigeminal nerves induces neurogenic inflammation (dilation and leakage of plasma protein) from arteries surrounding the brain, sensitization of nerve endings at these arteries, and sensitization of pain transmission circuits in the trigeminal nucleus. Pain then results when sensitized nerves are stimulated by dilated arteries sending pain signals through highly sensitized pain transmission circuits, but may also be influenced by a dysfunction in supraspinal (limbic) pain modulation systems.

### Tension-Type Headache

Frequent tension-type headaches are probably maintained by a central nervous system (CNS) dysfunction (Borkum, in press; Holroyd, 2002). This CNS dysfunction may involve the sensitization of

pain transmission circuits in the trigeminal nucleus where input from nerves in the face and head is first integrated and relayed toward the brain. Such sensitization would lower the threshold for the transmission of pain signals, so that little or no input from peripheral nerves (nociceptors) is required for the transmission of pain signals to the brain. A dysfunction in supraspinal (limbic) pain modulation circuits may also maintain pain by permitting, or even facilitating, the transmission of pain signals in the brain.

### Headache Precipitants

General population studies indicate that stress, sleep difficulties, and hormonal factors (relevant particularly for migraine) are the triggers most frequently identified by headache sufferers. *Stress* is the most frequently identified headache precipitant for both migraine and tension-type headache (Borkum, in press; Lipchik, Holroyd, & Nash, 2002). Headaches may be triggered by stress or by relaxation following a period of stress (“let-down headaches”). *Sleep* difficulties are commonly identified as a headache trigger, with insufficient sleep, oversleeping, or an irregular sleep schedule identified as most common sleep precipitants. Fluctuations in *reproductive hormones* (menarche, menstruation, pregnancy, menopause, hormone replacement therapy) are associated with headache disorders, particularly migraine. Close to 30% of people with headaches, primarily those with migraine, report that *dietary factors*, such as skipping or delaying meals, or ingesting specific foods (e.g., aged cheeses), beverages (e.g., red wine), or ingredients (nitrites or aspartame) sometimes trigger their headaches. *Environmental stimuli* (e.g., glare, chemical odors) also are commonly identified as headache triggers (Borkum, in press).

### Psychosocial Complications

#### *Medication Overuse Headaches*

Medication overuse or “rebound” headaches resemble chronic tension-type or chronic migraine headaches; however, it is the frequent use of prescription or nonprescription analgesic medications or abortive medications (combination analgesics, opiates, nonopioid analgesics, barbiturates, ergots, and other abortive agents including triptans) that is worsening the original tension-type or migraine headaches.

Medication overuse headaches can be managed effectively only if the use of the offending medications is reduced or eliminated (Silberstein & Dongmei, 2002).

### *Comorbid Psychiatric Disorders*

Epidemiological studies (Shechter, Lipton, & Silberstein, 2001) confirm that the prevalence of mood and anxiety disorders is elevated in migraine sufferers (relative risk typically between 2 and 3). Longitudinal data further argue that the association between mood disorders and migraine is bidirectional; for example, migraine increased the risk of a *subsequent* episode of major depression (adjusted relative risk = 4.8), but the presence of major depression also increased the risk of *subsequently* developing migraine (adjusted relative risk = 3.3) (Shechter et al., 2001).

The prevalence of both anxiety and mood disorders also appears to be elevated in chronic tension-type headache, at least in clinical samples. Over 40% of chronic tension-type headache patients in primary care settings, and even higher percentages of chronic tension-type headache patients seen in specialty settings, receive either an anxiety or mood disorder diagnosis. The presence of a comorbid anxiety or mood disorder appears to increase the disability associated with either tension or migraine headaches so effective management of psychiatric disorders may improve functioning (Holroyd, 2002).

### **Medical Management**

There are four goals of medication treatment.

*Symptomatic.* The goal of symptomatic therapy is to reduce pain. Symptomatic medications include analgesics prescribed primarily to reduce pain, such as nonsteroidal anti-inflammatory drugs (NSAIDs, COX-2), mixed analgesics containing barbiturates (e.g., butalbital) or opioids (i.e., codeine), and opioids alone (i.e., oxycodone). The use of opioid and mixed analgesics must be limited because overuse can cause rebound headaches and even addiction. NSAIDs and COX-2 inhibitors may be less likely to induce rebound headaches, but are not free from this problem.

*Abortive.* If taken early in the migraine episode, the goal of abortive therapy is to interrupt the migraine process, preventing a full-blown migraine from

developing; if taken late in the migraine episode, a more realistic goal is to reduce migraine symptoms. Abortive medications include NSAIDs, ergotamine derivatives, and serotonin-receptor agonists (triptans such as sumatriptan, rizatriptan, naratriptan, zolmitriptan, almotriptan, and eletriptan). These agents must be used no more than 2 to 3 days per week to avoid rebound headaches (Goadsby et al., 2002).

*Antiemetic.* The goal of antiemetic therapy is to reduce nausea and control vomiting. Antiemetics also improve the absorption of some oral medications, including analgesics, and may have antimigraine effects themselves. Antiemetics (e.g., prochlorperazine, metoclopramide) are used to treat the nausea and vomiting associated with migraines. Patients who experience nausea and vomiting are instructed to take an antiemetic before or along with their analgesic.

*Preventive.* The goal of preventive therapy is to reduce the frequency of headaches. Preventive or prophylactic medications for migraine include beta-blockers, calcium channel blockers, antidepressants (tricyclic, serotonin-reuptake inhibitors, and MAO inhibitors), anticonvulsants, and NSAIDs (Goadsby et al., 2002). Antidepressants (for the most part tricyclics) are the primary preventive medications for tension-type headache.

### **Psychological Management**

#### *Behavioral Interventions*

Behavioral interventions emphasize the *prevention* of headaches, although the same headache management skills can be used to influence the severity of headaches as well. The long-term goals of behavior therapy include reduced frequency and severity of headaches, reduced headache-related disability and affective distress, reduced reliance on poorly tolerated or unwanted pharmacotherapy, and enhanced personal control of headaches.

*Relaxation training.* Relaxation skills presumably enable headache sufferers to exert control over headache-related physiological responses and, more generally, to lower sympathetic arousal. Relaxation also may provide an activity break, as well as help individuals achieve a sense of mastery or self-control over their symptoms. Patients are typically instructed

to practice a graduated series of relaxation techniques 20 to 30 minutes per day, and, as they master brief relaxation techniques, to integrate relaxation into their daily activities (Borkum, in press).

*Biofeedback training.* Thermal (hand warming) feedback—feedback of skin temperature from a finger—and electromyographic (EMG) feedback—feedback of electrical activity from muscles of the scalp, neck, and sometimes the upper body—are the most commonly used biofeedback modalities. However, electroencephalographic (*neurofeedback*) and cephalic vasomotor biofeedback also are used experimentally (Borkum, in press). As with relaxation training, patients practice the self-regulation skills they are learning for about 20-30 minutes per day, and, as they master headache management skills, they are encouraged to integrate use of these skills into their day.

*Cognitive-behavioral (stress management) therapy.* Cognitive-behavioral therapy (CBT) focuses on the cognitive and affective precipitants and components of headache (Borkum, in press; Holroyd et al., 2001; Lipchik et al., 2002). Cognitive-behavioral interventions attempt to alert patients to the role their thoughts play in generating stress responses and to relationships between stress, coping, and headaches. Patients are encouraged to employ effective strategies for coping with headache-related stresses and headaches themselves.

*Integrating treatment techniques.* Typically, the above treatment techniques are not used in isolation but are used in the context of therapy that teaches multiple headache management skills and tailors headache management skills to the clinical characteristics of the clients' headaches and to their life situation. In addition to information about the clinical characteristics and pathophysiology of headaches and about behavioral headache management, this might include exercises in identifying headache triggers and early warning signs, exercises to enable patients to effectively use headache medications, strategies for coping with headaches that occur despite self-management efforts, and the development of a migraine management plan including a plan for coping with any recurrence of headaches following treatment. An outline of a representative therapy for migraine and for tension-type headache can be found in Lipchik and colleagues (2002).

### *Treatment Formats*

Treatment can be administered either individually or in a group, and can be administered in a clinic-based treatment format or in a home-based treatment format.

*Clinic-based treatment format.* Clinic-based treatment typically involves 6 to 12 weekly sessions, 45 to 60 minutes in length if treatment is administered individually, and 60 to 120 minutes in length if treatment is administered in a group. This treatment format provides more health care provider time and attention, and allows the provider greater opportunity to directly observe the patient than does a home-based treatment format, but requires the patient to travel more frequently to the clinic, and thus is more costly (Lipchik et al., 2002).

*Home-based treatment format.* Home-based or minimal-contact treatment involves 3 to 4 monthly treatment sessions 45 to 60 minutes in length for individual sessions, or 60 to 120 minutes in length for group sessions. Clinic visits introduce headache management skills and address problems encountered in acquiring or implementing these skills. Patient manuals and audiotapes guide the actual learning and refinement of headache management skills, which occur at home with phone contacts (Lipchik et al., 2002).

*Session structure.* With either treatment format, clinic sessions typically involve (1) a review of self-monitoring forms and homework, (2) a discussion of any difficulties encountered in learning and applying headache management skills, (3) the presentation of the rationale for the new headache management skill that will be the focus of the present session, (4) instruction and practice in this new skill, (4) formulation of a homework assignment, and (5) summary.

### *Efficacy*

*Migraine.* The Agency for Healthcare Research and Quality (AHRQ)<sup>1</sup> sponsored a comprehensive evaluation of evidence for medical, behavioral, and physical treatments for migraine. The AHRQ evidence reports provided the stimulus for the formation of the U.S. Headache Consortium, an affiliation of influential medical organizations<sup>2</sup> created to develop clinical

guidelines for the management of migraine. The U.S. Headache Consortium clinical guidelines, published on the American Academy of Neurology Web site (Campbell, Penzien, & Wall, 2000), conclude: "Relaxation training, thermal biofeedback combined with relaxation training, EMG biofeedback, and CBT may be considered as treatment options for the prevention of migraine." The AHRQ meta-analysis of data from available clinical trials found behavioral treatments to yield between 32% and 49% reduction in migraine activity (effect sizes ranging between .37 and .77) compared to 9% reduction in migraine activity with placebo (effect size .15).

*Tension-type headache.* The evidence report on the management of tension-type (and cervicogenic) headache prepared by the AHRQ (McCrory, Penzien, Hasselblad, & Gray, 2001) similarly concluded: "Behavioral treatments for tension-type headache have a consistent body of research indicating efficacy" (p. 7). The AHRQ meta-analysis of available clinical trials found that relaxation training, EMG biofeedback training, and CBT yielded between 37% and 50% reduction in tension-type headache activity (effect sizes ranging from .64 to .84); in contrast, 17% reduction in headaches has been observed with placebo (effect size of .15).

### Integrating Drug and Psychological Therapies

*Migraine.* Results reported in 25 trials of the preventive drug propranolol HCl and in 35 trials of combined thermal biofeedback plus relaxation (more than 2,400 patients) have been virtually identical: Each treatment yielded, on average, a 55% reduction in migraine activity, and in contrast, (pill) placebo yielded only a 12% reduction in migraine activity. In addition, two trials found that propranolol HCl significantly enhanced the effectiveness of combined relaxation/biofeedback training; however, in one trial propranolol HCl alone proved more effective than combined relaxation/biofeedback training, and about as effective as the combined treatment. Unfortunately, the high dropout rate (38% of patients) from combined relaxation/biofeedback training in that trial raises the possibility that outcomes were compromised by poor patient compliance (Holroyd, 2002).

*Tension-type headache.* In the AHRQ meta-analysis, results trials of behavioral treatments and trials of the preventive drug amitriptyline HCl yielded comparable outcomes. Two studies also provide information about combining psychological and drug therapy for tension-type headache. In one trial, the combination of amitriptyline HCl and EMG biofeedback training yielded more rapid improvement in tension-type headache activity than EMG biofeedback training alone; however, beginning at Month 8 and continuing through the 24-month evaluation period the combined treatment showed no advantage EMG biofeedback training alone. In fact, at the 20- and 24-month observation periods—after withdrawal from amitriptyline HCl—patients who received EMG biofeedback training alone recorded significantly fewer hours of headache activity than patients who received the combined treatment (Holroyd, 2002).

Holroyd and colleagues (Holroyd et al., 2001) examined the separate and combined effects of CBT and tricyclic antidepressant medication specifically for chronic tension-type headaches. Patients received one of four treatments: tricyclic antidepressant (amitriptyline HCl to 100 mg./day or nortriptyline HCl to 75 mg./day) medication, medication placebo, limited-contact CBT (three clinic sessions) plus antidepressant medication, or CBT plus placebo. Antidepressant medication and CBT each yielded moderate reductions in chronic tension-type headaches, analgesic medication use, and headache-related disability at a 6-month evaluation, but improvements tended to be more rapid in the two-antidepressant medication conditions than with CBT alone. Nonetheless, the combined treatment was more likely (64% of patients) to produce clinically significant ( $\geq 50\%$ ) reductions in chronic tension-type headaches than either antidepressant medication alone (38% of patients) or CBT (35% of patients) alone.

### SUMMARY

Recurrent headache disorders are highly prevalent and associated with significant impairments in functioning and health care costs. Although our understanding of headache disorders has progressed significantly in the past decade, the pathophysiology of headache disorders remains incompletely understood. Fortunately, effective medical and behavioral treatments are available and most individuals who

suffer with a recurrent headache disorder can benefit from one of the available treatments or combination of treatments.

—Kenneth A. Holroyd

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See also CHRONIC PAIN MANAGEMENT; PAIN: PSYCHOSOCIAL ASPECTS

## Notes

1. Previously the Agency for Health Care Policy and Research.
2. American Academy of Family Physicians, American Academy of Neurology, American Headache Society, American College of Emergency Physicians, American College of Physicians, American Osteopathic Association, and National Headache Foundation.

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## HEALTH AND BEHAVIOR ORGANIZATIONS

### SOCIETY OF BEHAVIORAL MEDICINE

The Society of Behavioral Medicine (SBM) was founded in 1978 as a multidisciplinary, nonprofit organization to advance the science and practice of behavioral medicine. Today, SBM is the nation's premiere multidisciplinary organization dedicated to advancing the service and practice of behavioral medicine. SBM represents more than 2,000 behavioral and biomedical researchers and clinicians from over 18 different disciplines (e.g., psychophysiology, psychology, medicine, epidemiology, genetics, psychoneuroimmunology, nursing, health education, medical sociology, biostatistics, health policy). SBM's membership spans from student members and new investigators to the nation's leading experts in behavioral medicine research, practice, and policy. SBM provides the many disciplines represented with an interactive network for education and collaboration on common research; clinical and

public policy concerns related to prevention, diagnosis, and treatment; rehabilitation; and health promotion.

SBM has a two-part mission: (1) to advance the development of scientific knowledge about the behavioral, biological, and social determinants of health and disease, and (2) to promote the application of this knowledge to improve individual and population health outcomes. SBM's goals are to advance this mission through a number of related activities, including sponsoring scientific meetings and publications that promote excellence in behavioral medicine research and practice, and maintaining and fostering the development of multidisciplinary leadership for the field.

SBM holds an annual scientific meeting consisting of invited addresses, debates, symposia, workshops/seminars, papers, and poster sessions. The first annual meeting was held in 1979. SBM's other major activities include publication of *Annals of Behavioral Medicine*, which aims to foster the exchange of knowledge derived from the disciplines involved in the field of behavioral medicine and the integration of applicable basic and applied research (published by Lawrence Erlbaum Associates); *Outlook*, a quarterly newsletter; and a Web site, [www.sbmweb.org](http://www.sbmweb.org).

The organization's structure includes officials elected by the membership, an executive committee, and council and committee chairs appointed by the executive committee. The elected officials include a president, elected to a 1-year term; a secretary-treasurer, elected to a 3-year term; and three member delegates, elected to staggered 3-year terms. The executive committee consists of the elected officials as well as the president-elect and past-president. Councils include Education and Training, Membership, Publications and Communications, and Scientific and Professional Liaison. Committees include Nominating, Finance, Program, Program Oversight, Long Range Planning, and Electronic Communications. There are different levels of membership including student, full, and fellow. In 2002, SBM had 2,100 members.

For further information about SBM, see the Web site, [www.sbmweb.org](http://www.sbmweb.org).

#### INTERNATIONAL SOCIETY OF BEHAVIORAL MEDICINE

The International Society of Behavioral Medicine (ISBM) is a federation of national societies, whose goal is to serve the needs of all health-related disciplines

concerned with issues relevant to behavioral medicine. Each national society includes both biomedical and behavioral scientists. Constituent societies of the ISBM presently include Academy of Behavioral Medicine Research (USA); American Psychosomatic Society; Austrasian Society of Behavioral Health and Medicine; Behavioral Medicine Section of the Czech Medical Association; Finnish Section of Behavioral Medicine of the Finnish Association of Social Medicine; Danish Society of Psychosocial Medicine; German Society of Behavioral Medicine and Behavior Modification; Hungarian Society of Behavioural Sciences and Medicine; Japanese Society of Behavioral Medicine; Netherlands Behavioral Medicine Federation; Norwegian Society of Behavioral Medicine; Psychosomatic and Behavioral Medicine Section of the Slovak Medicine Society; Society of Behavioral Medicine (USA); Swedish Society of Behavioral Medicine; and the Venezuelan Interdisciplinary Group of Behavioral Medicine. The Division of Health Psychology of the American Psychological Association and Society of Pediatric Psychology (USA) are affiliate members.

The function of the ISBM is to conduct activities that stimulate research and practice and coordinate communication and interaction within the worldwide behavioral medicine community. One important way to disseminate the concepts and findings of behavioral medicine throughout the world is through the international congresses sponsored by the ISBM. The first international Congress of Behavioral Medicine was held in Uppsala, Sweden, in 1990; the most recent, the seventh, was held in Helsinki, Finland, in 2002, and the eighth will be held in Mainz, Germany, in 2004. A second important way to disseminate the concepts and findings of behavioral medicine throughout the world is through a major scientific journal. The *International Journal of Behavioral Medicine (IJBM)*, published by Lawrence Erlbaum Associates, is the official journal of the ISBM. A third important way to disseminate the concepts and findings throughout the world is through teaching seminars. Seminars have been held in Stockholm, Sweden; Caracas, Venezuela; Bangkok, Thailand; and Vindeln, Sweden.

The ISBM structure includes the Governing Council; elected officials; the Executive Committee; and the Standing Committee. The Governing Council is made up of representatives of each member society, as well as the elected officials and committee chairs. The elected officials include a president, elected to a 2-year term, and a secretary and a treasurer, both



elected to 3-year terms. Committees include Communications, Education and Training, International Collaborative Studies, Membership, Organizational Liaison, and Program.

For further information about the ISBM, see the Web site, [www.isbm.miami.edu](http://www.isbm.miami.edu).

#### DIVISION OF HEALTH PSYCHOLOGY (DIV. 38) OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION

The purpose of the Division of Health Psychology is to advance contributions of psychology as a discipline to the understanding of health and illness through basic and clinical research and by encouraging the integration of biomedical information about health and illness with current psychological knowledge; to promote education and services in the psychology of health and illness; and to inform the psychological and biomedical community, and the general public, on the results of current research and service activities in this area.

Division 38 was established in 1978 to facilitate collaboration among psychologists and other health science and health care professionals interested in the psychological and behavioral aspects of physical and mental health. Division 38 supports the educational, scientific, and professional contributions of psychology to understanding the etiology and promotion and maintenance of health; the prevention, diagnosis, treatment, and rehabilitation of physical and mental illness; the study of psychological, social, emotional, and behavioral factors in physical and mental illness; the improvement of the health care system; and formulation of health policy.

Given its emphasis on behavior and behavioral change, psychology has a unique contribution to make. For example, health psychologists are currently conducting applied research on the development of healthy habits as well as the prevention or reduction of unhealthy behaviors. Psychosocial and physiological linkages in areas such as psychoneuroimmunology, cardiovascular disorders, and other chronic diseases are being defined. Psychologists are in increasing demand in health and medical settings. The single largest area of placement of psychologists in recent years has been in medical centers. Psychologists have become vital members of multidisciplinary clinical and research teams in rehabilitation, cardiology, pediatrics, oncology, anesthesiology, family practice, dentistry, and other medical fields.

The organizational structure of Division 38 includes elected officials (president, secretary, treasurer, and two members-at-large), an executive committee, and standing committees. The standing committees include Convention Program, Education & Training, Research, Health Services, Publications, Finance, Awards, Fellows, Membership, and Nominations and Elections. There are approximately 3,000 members belonging to Division 38. The division holds its annual meeting as part of the American Psychological Association's annual meeting held each August. *Health Psychology* is a scholarly journal, published six times a year, that disseminates scientific investigations examining psychological/behavioral and physical health/illness relationships.

For further information about the Division of Health Psychology, see the Web site, [www.health-psych.org](http://www.health-psych.org).

For additional information about the history of Division 38, see Wallston (1997).

#### AMERICAN PSYCHOSOMATIC SOCIETY

The mission of the American Psychosomatic Society (APS) is to promote and advance the scientific understanding of the interrelationships among biological, psychological, social, and behavioral factors in human health and disease, and the integration of the fields of science that separately examine each, and to foster the application of this understanding in education and improved health care. The task of psychosomatic medicine is to understand the nature and mechanisms of behavior and psychosocial encounters that may alter the development of the organism, its structure, and its functions. The understanding of these encounters, provided by psychosomatic research and clinical studies, is an essential ingredient for the comprehensive understanding of human disease in order to lessen the burden of human suffering. The study of these factors and their assimilation into medical teaching and practice are central to the mission of the APS.

The APS grew from a desire among several academicians, practitioners, and foundations to link developments in psychology and psychiatry to internal medicine, physiology, and other disciplines. APS was founded in 1943. APS holds its annual meeting in March. The meeting is devoted to the presentation of scientific papers, symposia, workshops, poster sessions, invited lectures, and addresses. As the official organ of the APS, the purpose of the journal, *Psychosomatic Medicine*, is to present experimental

and clinical studies dealing with various aspects of the relationships between social, psychological, and behavioral factors and bodily processes in both human and lower animals. The journal is published six times a year. As of 2002, APS has 874 members. There are four categories of membership: regular, associate, emeritus, and corresponding.

The affairs of the APS are governed by a council of 17 members, 7 of whom are ex-officio: 3 elected annually; 13 of whom are elective, serving 3-year terms; and 1 elected for a 2-year term. The ex-officio members are the president, the president-elect, the secretary-treasurer, the outgoing president, the journal's editor-in-chief, the program committee chair, and the newsletter editor. The elected members are chosen to provide appropriate representation to the following fields: internal medicine; psychiatry; pediatrics; neuro-anatomy; physiological sciences, neurophysiology, and psychophysiology; psychology; clinical psychology; sociology; anthropology; and public health.

For further information about the APS, see the Web site, [www.psychosomatic.org](http://www.psychosomatic.org).

—Marc Gellman

See also APPENDIX A

### Further Reading

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## HEALTH BELIEF MODEL

What does it take for people to act to protect themselves from illness? This is the fundamental question posed by the framers of the health belief model (HBM), and which has continued to be addressed by researchers over the past five decades in the disciplines of public health, health psychology, and health education.

**Background.** The HBM was originally developed by Godfrey Hochbaum and other research psychologists in the U.S. Public Health Service in the early 1950s as they sought to apply the theories and methods of

behavioral science to understanding and predicting health behavior. The original work in this area grew out of an attempt to understand the limited utilization of public health programs for disease prevention and screening (including tuberculosis screening). Hochbaum and his associates, including Irwin Rosenstock, were trained as social psychologists. They drew influences from contemporary learning theory and cognitive theory, particularly the work of Kurt Lewin and others who emphasized the importance of the individual's perceptual and cognitive processes, specifically the perception of the valuation of and expectations regarding particular outcomes in determining a course of action.

The HBM is a value-expectancy theory that attempts to describe the valuation of the desire to avoid illness (or treat it effectively) and the types of expectations about health that are essential in influencing preventive (or self-care) behavior. The HBM has evolved over the years from addressing primarily health-screening behavior to applications covering the full range of health behaviors from lifestyle change for primary prevention to management of chronic illnesses and sick-role behavior.

### KEY CONCEPTS OF THE HEALTH BELIEF MODEL

The central variables of the HBM have been redefined over time to incorporate a number of concepts beyond those originally considered (perceived susceptibility to the risk and the perceived benefits of early detection, plus a cue to action) to include the following:

1. *Perceived threat* is a combination of two concepts:
  - a. *Susceptibility* is the subjective perception of the individual's risk of developing an illness. In the context of an existing illness, it includes susceptibility to complications of advancing or recurrent disease and acceptance of the diagnosis, as well as more general susceptibility to health problems.
  - b. *Perceived severity* is the sense of how serious an illness is and the consequences of leaving it untreated. This concept includes the perception of the possible physical consequences of an illness (e.g., pain, death) and the broader range of social consequences in a person's life (e.g., disability, stigmatization).
2. *Perceived benefits* relate to the anticipated positive effects of taking action. This includes beliefs about

the effectiveness of a course of action in reducing the disease threat, as well as other potential benefits not directly related to health (e.g., quitting smoking might be seen as a way to save money or set a good example for one's children).

3. *Perceived barriers* are the potential negative consequences or costs associated with taking an action to improve health. The factors that could impede a course of action might include concerns about the expense, any possible discomfort or danger associated with the action (e.g., fears about pain or radiation exposure from a mammogram), inconvenience, or competition with other valued activities (e.g., having to miss work to get to an appointment). As noted above, the wide range of potential barriers include logistical barriers such as cost or lack of convenient access to services, and emotional barriers such as fears about physical or emotional harm (including fear of getting a cancer diagnosis). In addition, when addressing changes in lifestyle and personal habits that may be rewarding in their own right (eating high-fat foods or smoking cigarettes), the habit strength or the loss of pleasurable activities (if not addiction) may prove to be potent barriers to health behavior change.

4. *Cues to action* (either internal cues such as thoughts, emotions, or sensations, or external events that act as a prompt) were one of the initial concepts in the HBM. Interestingly, this component of the model has not been as systematically studied as several of the others. Nonetheless, examples clearly exist in effective screening and health maintenance interventions that derive from this concept, such as the success of reminder systems for screening tests. Another example is the phenomenon of having a cancer diagnosis of a relative or friend act to motivate people to obtain a first mammogram or colorectal-screening test.

5. *Other modifying variables* include an array of demographic and sociocultural variables that may greatly influence the performance of health behavior directly, or may interact with the perceptions of susceptibility or seriousness. A particularly powerful example of this variable is a person's level of education, the addition of which has improved the predictive accuracy of the model.

6. *Self-efficacy* as a variable was a relatively late addition to the HBM. The concept of self-efficacy, developed

by Albert Bandura in 1977, addresses an additional expectancy that influences the performance of a health behavior. Self-efficacy refers to the level of confidence a person feels regarding his or her ability to perform a behavior. Bandura described a number of processes by which a person's sense of self-efficacy may be influenced, and this issue is particularly important when trying to predict or influence the adoption of new behavior patterns or the changing of lifestyle and habits to improve health outcomes. For example, confidence regarding one's skill at being able to test blood sugar and accurately self-administer insulin is essential to the consistent performance of diabetic self-management.

In summary, the HBM posits that adopting a health behavior change typically requires several beliefs and situations working in concert. First, people must be aware of the health risk and perceive it to be sufficiently serious and likely to affect them to consider taking action. They also need to believe that a particular behavior will be effective in protecting them from a bad outcome in order to overcome whatever possible costs or downside risks they may be concerned about. Moving them toward action may also require the perception of bodily sensations, or events in their physical or social environment to prompt them to act sooner rather than later. In addition, particularly if the required behavior change is the alteration of an element of their lifestyle (rather than a one-shot preventive event), they need to feel that the behavior change will not only be effective but is something they are capable of doing.

## EMPIRICAL EVALUATION OF THE HEALTH BELIEF MODEL

A recent MEDLINE search of the HBM found more than 2,300 references, which suggests the scope of the task of summarizing the research influenced by this model. The interested reader is referred to the periodic detailed reviews of the empirical findings and the theoretical advancements in the model. An exhaustive review of the early findings in 1974 by Marshall Becker summarized evidence that there was considerable support for the predictive validity of the variables in the model in several domains of preventive health behavior, screening, and self-care. An updated review by Becker and Nancy Janz in 1984 reflected a burgeoning literature using the model, with extensions of the HBM to the use of

inoculations, breast cancer screening, genetic testing, cardiovascular risk factors screening, smoking, and chronic illness management including adherence to asthma, hypertension, and diabetic regimens, including medication, diet, and other health behavior changes. Important theoretical papers have further integrated research findings and advanced the HBM concepts, contributed by Rosenstock and colleagues including Victor Strecher, in the integration of Bandura's social cognitive theory concepts, and in the application of the HBM to chronic illness and sick-role behavior.

Overall, to the extent there are consistent patterns of findings, perceived barriers appear to be the strongest predictor across all kinds of health behavior. Perceived susceptibility appears to be the next strongest predictor of preventive behavior, whereas perceived benefit is a better predictor of self-care behavior in a chronic illness. More recent multivariate modeling has examined the paths by which the variables act in concert to predict health behavior. For example, perceived severity, which frequently is among the weaker predictors of behavior by itself, may exercise its influence on behavior through strengthening the importance of perceived benefits.

Interestingly, the somewhat unwieldy mass of research launched by the HBM has made relatively modest contributions to the theoretical development of the model. The theory itself offers very little specificity regarding the measurement of the variables and relationships between variables. For example, the model implies, but does not specify, that the effects of the variables take place within a sequential process (i.e., barriers are not relevant unless the person perceives some personal susceptibility and seriousness regarding the risk). Also, there are no specific hypotheses about whether the variables affect each other via additive or multiplicative means.

The lack of structure in the model has left researchers free to define the concepts and interpret the relationships as they will. In fact, in some respects the HBM and its variables have served as the root from which most of the health behavior models currently being researched have branched. Other models with similar social and cognitive psychology origins have used the HBM variables in their health behavior applications, but have advanced specific hypotheses regarding the combination principles of the variables and the decision-making process (e.g., the theory of planned behavior

and its successor, the theory of reasoned action by Martin Fishbein and Icek Ajzen). Howard Leventhal's added emphasis on the emotional processing that takes place in parallel to the rational, cognitive cost-benefit decision making of the HBM evolved into his self-regulatory model, and others, such as Suzanne Miller's cognitive-social information processing (C-SHIP) model, which also adds emphasis on social cognitive elements. The insight that behavior change is a process that may unfold over time, rather than an event that happens all at once, has inspired stage models such as the transtheoretical model of James Prochaska and his colleagues, and Neil Weinstein's precaution adoption process model. As the common ancestor, the HBM's conceptual DNA can be found in these models and the research they have inspired.

It has been suggested in several recent reviews by Strecher, Rosenstock, and others that researchers seeking to use the HBM as a conceptual base should (1) pay closer attention to specifying the measurement of the variables; (2) work in more of a hypothesis-testing mode; and (3) examine the relationships between the HBM variables and outcome behaviors in a manner that would yield meaningful information, for example, specifying risk perception with respect to behavioral anchors (e.g., *if you do not quit smoking*, how likely are you to have another heart attack?). The recommendation is that the variables not be tested alone, or tossed into a regression model trying to test for the "strongest swimmers," but rather to elucidate the relationships among variables as they relate to the desired health behavior.

Ultimately, an important goal of the HBM is to inform practice. The HBM has now been applied to populations around the globe to AIDS prevention and treatment, the management of a wide variety of chronic illnesses, cancer prevention and screening, immunization utilization, teen pregnancy, and even examining the influence of the providers' health beliefs as they affect health disparities in minority populations. The HBM and the research inspired by it have already contributed much to the development of effective interventions at the individual and group levels for promoting preventive and self-care health behavior, but much remains to be learned. With greater precision and consistency in measurement and more specific, hypothesis-driven analyses of the interactions and paths by which the variables exert their influence, the blueprints for more precise and effective

interventions can be drawn, tailored to the needs of the individual and the demands of the situation.

—Lynn Clemow

See also SELF-EFFICACY; THEORY OF PLANNED BEHAVIOR; THEORY OF REASONED ACTION; THEORY OF TRIADIC INFLUENCE; TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

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## HEALTH CARE COSTS AND BEHAVIOR

Economic costs are the value of resources consumed in an endeavor. Health care costs are therefore the value of resources used in the provision of health care. These resources include the professional services of health care providers, the facility resources used in providing these services in settings such as hospitals and clinics, pharmaceutical therapy, specialized health services such as radiology and pathology, and health care supplies. A more expansive definition of costs related to health care would include the time

required by patients to attend therapy and the support of family caregivers, as well as the true value of pain and suffering related to treatment, less the value of improvements in health.

Resources are valued at their opportunity cost, which is the value of the activity forgone in order to employ the resource. In a competitive market, where suppliers and consumers freely trade their goods and services, opportunity costs may be approximated by market prices. In the health care sector, prices are often distorted by incentives for reimbursement related to health insurance and institutional cost shifting among patient groups including the uninsured. Furthermore, prices are often unobserved, as is the case when services are provided under capitated contracts. Thus, measuring costs often involves a combination of methods including the estimating of costs incurred by facilities, the relative values of physician effort and outpatient procedures, and the average wholesale price of pharmaceuticals.

An important concept when making decisions regarding health care is relative cost. For example, the decision to employ one particular therapy over another may be determined by the relative costs of the two therapies and how they relate to the relative benefits. Often this is conceptualized as incremental costs and benefits. Incremental costs might be the additional costs of one therapy over another. If benefits are valued in monetary terms, one can calculate incremental net benefit, or the incremental benefits less the incremental costs. Incremental costs and benefits are used in economic evaluations of health care programs and include cost-analysis (the economic cost of a program including any cost savings that result), cost-effectiveness analysis (the cost of a program for a given non-monetary measure of benefit or outcome), and cost-benefit analysis (the total economic value, benefits less costs, when all are valued in monetary terms).

A common form of economic evaluation in health care is cost-effectiveness analysis. Cost-effectiveness analysis is popular in health care evaluation because it allows one to incorporate a measure of the health benefit, the quality of adjusted life year (QALY), but does not require that this benefit be valued in monetary terms. A change in QALYs represents changes in both length of life and quality of life, the latter of which might be approximated by level of functioning. In cost-effectiveness analyses, alternative health care options are presented with respect to their incremental cost-effectiveness, or the difference in costs between a

base case and the proposed alternative divided by the difference in outcomes. Sometimes an evaluation will reveal that a proposed change in health care delivery, such as the adoption of a new technology, is cost saving. However, the typical result is that the change would result in additional benefits at an additional cost. It may then be compared to other health care practices currently in use to determine whether it may be considered “cost-effective,” a determination that is ultimately subjective, determined in part by the preferences of health care consumers and their willingness to pay for a given level of health benefit.

Cost-effectiveness analysis can be useful not only in deciding between competing health care practices or technologies but also determining at what point to intervene. Resources aimed at reducing morbidity related to a particular disease may be aimed at prevention, screening, or treatment. For example, several health policy options are available to reduce morbidity related to diabetes—ultimately to improve quality of life. These include the intensive treatment and case management of persons with diabetes, with the objective of avoiding future complications; increased screening to reduce the time between onset and initial treatment; and prevention of or lengthening of time until onset among persons who are either glucose intolerant or otherwise at high risk of developing diabetes. Analyses have shown each of these health care practices to be cost-effective. In contrast, some mass screening programs increase treatment without reducing morbidity or mortality. These are generally not cost-effective.

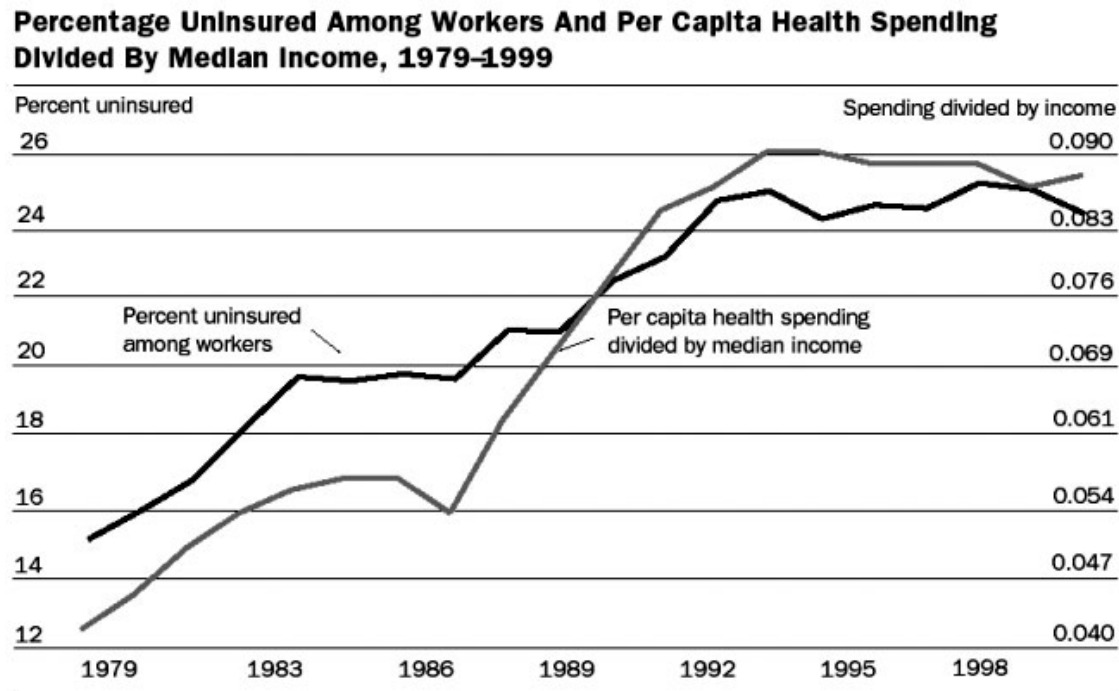
Economic evaluation is a valuable tool that can be used to help determine the efficient allocation of health care resources across alternative health practices. The analysis of aggregate health care expenditures provides a better understanding of how resources are spread across health care sectors and the level of health spending relative to the overall economy. The remainder of this entry reviews the amount and distribution of health care costs as approximated by the federal accounting of health care expenditures: National Health Care Expenditures (NHE) as summarized by the Center for Medicare and Medicaid Services (CMS) in 2000. It then examines the evolution of health care costs over time and relates the apparent increase in costs to the interrelated effects of health insurance and technological change. Following is a discussion of the desirability of allowing health care costs to consume an increasing share of national

income. The entry concludes with discussion of probable scenarios for the future of health care costs.

NHE totaled \$1.3 trillion in 2000, or \$4,637 per U.S. resident, and 13.2% of gross domestic product (GDP). Fifty-five percent of expenditures originated from private sources including health insurance, out-of-pocket payments, and philanthropy; 45% were public expenditures, the largest components of which were federal expenditures on Medicare and expenditures by federal, state, and local governments on Medicaid. Nearly one third of expenditures were for hospital care (31.7%); another third were for professional services including physician, clinic, dentistry, and home health care (32.2%). Pharmacy expenditures were 9.4% of NHE in 2000; nursing home care, 7.1%; administration, 6.2%; and public health activity and research were 5.4%.

Expenditures as a percentage of GDP grew steadily since they were first recorded in 1960 at 5.1% until 1993 when they reached 13.4%. From 1993 to 2000, this ratio has been relatively stable at just over 13%. The distribution of health care expenditures in 2000 is similar to the distribution in 1960, although this masks a large swing in hospital expenditures, which increased as a percentage of NHE from 34% in 1960 to 42% in 1982, with corresponding declines in the percentage of NHE accounted for by professional services and pharmaceuticals. The subsequent decline in hospital expenditures as a percentage of NHE left hospital, professional, and pharmacy ratios in 2000 very close to their ratios in 1960. Notable increases have occurred in administration expenditures, which rose from 3.2% of NHE in 1960 to 6.2% in 2000, and nursing home expenditures, which rose from 4.5% to 7.1%.

It is largely accepted that the rapid increase in NHE that has occurred over the past 40 years is the joint result of advances in technology coupled with the risk-sharing arrangements offered by health insurance. The use of increasingly expensive technologies is evidenced by the inexorable rise in hospital and physician expenditures, and recently in rising expenditures for prescription drugs. Use of these technologies, however, depends both on their availability (supply) and the demand of consumers, which are affected by preferences and price. Traditional fee-for-service health insurance, which allowed widespread access to these technologies through risk spreading, also effectively removed the price sensitivity by consumers that determines efficient outcomes in market equilibrium.



**Figure 1** Percentage Uninsured Among Workers and Per Capita Health Spending Divided by Median Income, 1979-1999

SOURCE: Author's analysis of Current Population Survey, March supplements, Annual Demographics Files, 1980-2000, except 1981; and Centers for Medicare and Medicaid Services, National Health Accounts, 1979-1999.

This large increase in health care expenditures as a percentage of GDP is not necessarily detrimental to the U.S. economy. Consumers' spending is driven in large part by their preferences, and it may very well be that consumers prefer to invest an increasing share of their incomes in their health care. There exist, however, at least two fairly convincing pieces of evidence that some health care spending is inefficient and that a reallocation, or possibly even a reduction, in expenditures would make consumers in the United States better off.

The first piece of evidence is the well-documented variation in health care utilization, including hospitalization, and associated costs across the country. The question has been posed as, Which rate is right? In light of comparable mortality rates, it may be that areas of the country with high utilization rates are treating patients too aggressively. There is equally weighty evidence that others do not receive care with potentially high benefits: Those in families with low incomes, as well as those who are African American or Latino, have worse access to medical care and

worse health outcomes than those with higher incomes and those who are White. The apparent conclusion is that our health care resources are not distributed such that each dollar is worth what it is buying. Although the overall purchase might be worth it, the value of health insurance would likely increase if some dollars were spent in other areas, and on other consumers.

A second evidentiary item demonstrating decreasing returns to health technology is the decline in the percentage of persons with health insurance. As shown in Figure 1, the percentage of uninsured among workers has increased in direct relation to per capita health spending as a share of income. Economic theory posits that for a given commodity, any increase in its value would increase the likelihood of insuring against its loss, provided that persons are risk adverse. That consumers are not continuing to purchase insurance suggests that increases in health care costs, and the corresponding increases in the price of insurance, are not indicative of increases in value.

It is expected that health expenditures will increase, as will the number of uninsured, until there exists a political consensus to substantially alter the way health care is distributed and financed. Expanding coverage to the uninsured might be accomplished either through the expansion of public programs such as Medicaid or by adoption of universal coverage. Either approach will increase health care expenditures simply by increasing access to care by the uninsured. A more important decision is how to adjust the financing of health care to more efficiently distribute resources.

—Todd Gilmer

See also COST-EFFECTIVENESS; HEALTH CARE SERVICE UTILIZATION; DETERMINANTS; QUALITY OF LIFE; MEASUREMENT

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## HEALTH CARE SERVICE UTILIZATION: DETERMINANTS

Health care service utilization can be defined as the use of any services provided to a patient in an attempt to improve or maintain health. Such services would include those provided by medical professionals or any allied health care provider (e.g., psychotherapist, home health nurse) and any diagnostic or treatment procedures delivered. Determinants of utilization of services must be clearly distinguished from determinants of health. Often low rates of utilization may reflect poor health due to low access to services, yet at other times low rates of service utilization may be viewed as a measure of health due to a lack of need of services. Two primary issues need to be understood when using health care service utilization as a variable in research: factors that influence utilization and

confounding of these factors, and the methods used to measure service utilization.

One of the first factors used in the study of health care service utilization is how encompassing the term may be. That is, a separation is often used between medical utilization and behavioral health services. Though in part as a result of greater parity between health and mental health services this distinction is lessening, still some researchers have differentiated between these two as tracking systems for these two may be separate.

### DETERMINANTS OF UTILIZATION

Several influences on the utilization of health care services have emerged: sociodemographic, behavioral risk factors, and personal and clinical history.

#### Sociodemographic Factors

Sociodemographic factors include age, gender, and ethnicity. Age is associated with declining health status, greater morbidity of most diseases, and thus utilization of services increases. In fact, many reports have estimated that more than half of one's health care expenditures during one's lifetime are devoted to the final few weeks of life. However, infants and children use services more often than do healthy adults. Gender has also been frequently associated with health and health care utilization. Generally, women are found to access health care more often than men. For example, studies have found that women are referred to further cardiographic testing less frequently when complaining of the same symptom cluster as men; while this difference may show up as greater service utilization for men this is seen as a contributing factor to women's higher fatality rate of first time myocardial infarctions.

Populations that are associated with low social support and poor economic conditions (e.g., divorced, widowed, minorities, low education, low income) tend to use health services more frequently. However, these socioeconomic factors tend to be highly correlated with each other. Numerous studies have reported that non-Hispanic Caucasian patients are more likely to receive primary and secondary preventive services and thus are less likely to need services over time due to improved outcomes in a variety of health domains. For example, after controlling for confounding factors such as age, gender, income, and availability



of procedures, African Americans and Latino patients were less likely to receive coronary artery bypass, angioplasty, revascularization, or arteriography than Caucasian patients. Research examining service utilization of millions of elderly Medicare enrollees show that non-Hispanic Caucasian patients received more mammograms, as well as more influenza vaccines, yet racial differences were not apparent for non-elective procedures such as hip replacement surgery. While many of these studies have controlled for the effects of reimbursement to isolate the differences between racial groups, other studies have isolated the impact of reimbursement directly on utilization. That is, physicians tend to avoid the uninsured and underinsured patients due to inadequate reimbursement, difficulty providing “standard of care given financial constraints,” and the perception of higher rates of treatment noncompliance associated with these patients. Language-discordant patient-physician pairs have been correlated with increased noncompliance with medications, missed scheduled appointments, and more visits to the emergency room than language-concordant patient-physician dyads. Policy reforms and changes in medical education are often touted as remedies for these systems limitations.

### Behavioral Risk Factors

Behaviors that increase risk of chronic illness are often associated with higher service utilization. Such behaviors include smoking, alcohol and substance abuse, a sedentary lifestyle, and overeating. Conditions that result from such behaviors—for example, diabetes, hypertension, and fetal alcohol syndrome—are associated with increased demands on the health care system over a prolonged period of time. Hostility and aggressive behavior have also been associated with coronary artery disease, increased rate of traumatic injuries that require intense medical attention, and increased service utilization.

### Personal and Clinical History Factors

One’s personal history is associated with increased utilization. Childhood abuse and posttraumatic stress disorder from that and other events are associated with not only increased mental health services, but a higher incidence of such histories is found in those seeking medical services as compared to those who do not use health care services frequently. Specific physiological

markers are often seen as intermediate markers of increased health care service utilization. Blood pressure, HbA1c (diabetes), weight/obesity, and cholesterol are just a few examples of intermediate markers for increased service utilization across the life span.

### METHODS OF MEASUREMENT

The method of measurement will be influenced by the focus of what is being measured. That is, if one is assessing overall impact of an intervention then one must also look at costs incurred over time both in the health care system and outside the health care system. Another important issue involved in the measurement of utilization is the time delay of impact expected. That is, preventive services may be offered with little expectation of reduction in service utilization until many years later.

It is very important to understand that health care service utilization can be measured in a multitude of ways. Self-reports of visits to a health care provider are most often used in research. However, several researchers have noted that such self-report strategies are prone to biased recall to varying degrees. Another way to quantify utilization is by assessing costs. One way to avoid such biased reporting is to access actual billing system data (claims data) and count the frequency of services or the costs of such services. The issue in accurately documenting cost is very complex in that regional variations of cost of procedures may make generalization of actual costs nearly impossible. If one is looking at the frequency of visits to providers, there is often differentiation between inpatient and outpatient care, with costs different for each and their accessibility and relevance of the data a question that must be asked prior to resources being devoted to extracting such data. Researchers have also used the number of procedures received by a patient (including laboratory data, radiology assessment technology, or outpatient surgeries), and thus cost is confounded with payor system.

### FINAL ISSUES

There are many other issues to be considered when using service utilization in research. One such issue is the time delay of any expected impact of an intervention. That is, if an intervention is to improve one’s health it likely is perceived first by the patient, then observed in improved functioning, and perhaps only after a sufficient period of time has passed will it

affect the frequency of future health service utilization. That is, preventive services are often promoted as decreasing utilization, yet in some analyses (e.g., cost-utility analyses) it may be difficult to show true effectiveness because of the time delay in benefits.

A controversial issue is determining the “appropriateness” of utilization; whether or not an encounter with the health care system (e.g., preventive health visit, emergency room visit) is appropriate can be very subjective. It is hard to define “appropriate” use of services at a group level when some diagnostic tests may be appropriate for some population at risk but not for others; taking into account the clinical realities of variations in appropriateness between patients is often difficult to incorporate into cross-sectional or cohort research designs.

Another issue is tracking “out of system” costs in that more people are using services from providers not included in the covered systems that use claims databases. Complementary and alternative health care being sought more and more is often not included if one is tracking utilization by electronic systems of data collection.

Cost-offset is another issue to be considered when examining the impact of an intervention on health and utilization outcomes. An important idea with this issue is to account for the cost of an intervention when determining the impact of the intervention; for example, the cost of mental health services often minimizes the medical cost-savings realized from such interventions. Similarly, cost-benefit analyses can be more complicated than may be initially perceived. That is, how one measures benefit—patient quality of life, functioning level, return to work—can lead to very different results.

Cost-effectiveness analyses and cost-utility analyses are just two of many other ways to assess the impact of an intervention on health service utilization. The reader is referred to such topics elsewhere in this volume.

—William J. Sieber

See also COST-EFFECTIVENESS; HEALTH CARE COSTS AND BEHAVIOR

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## HEALTH COMMUNICATION

Health communication in its broadest definition is any type of communication whose content is concerned with health. As a field, however, health communication is more clearly defined as the process through which one person, group, or governmental or private organization uses various communication strategies and channels to educate, motivate, and perpetuate information, skills, and behaviors that are generally accepted to benefit (improve) the health of individuals and the public. This can occur at the individual, interpersonal, national, and global levels. Health communication is concerned with the strategic use of ethical, persuasive means to craft and deliver campaigns and implement specific strategies designed to promote good health and prevent disease. Ideally, health communication is the *right* information to the *right* people at the *right* time for an intended, beneficial effect.

Informed opinion and active cooperation on the part of the public are of utmost importance in the improvement of health of the people. (World Health Organization, Preamble to the Constitution)

Many would argue that health communication—through mass media and social marketing campaigns—works best at reinforcing existing attitudes and beliefs to provide people with the skills and resources necessary to make personal behavior changes. Health communication campaigns fail when a message does not reach or is not understood by the target audience. Suffice it to say it is difficult to change strongly held attitudes, which are necessary in changing behavior in the long term. A popular technique in health communication is community centered communication—focusing on the unit of change at the community level, thereby empowering individuals within that body to effect change on multiple levels presenting a variety of points.

In its infancy, health communication efforts primarily focused on reinforcing existing attitudes and beliefs, had unrealistically high expectations for long-term behavior change, and generally did a poor job of reaching the intended audience. This was the “pretelevision era,” and most health communication efforts (primarily radio public service announcements and printed materials) were viewed by the public as dry, dull, and boring. In the 1970s, health communication entered into the “era of successes” where specifically targeted media were effective. Today, we are in the 21st century—the “era of moderate effects” or the “communication age,” where health communication campaigns have enjoyed more success in being able to change a specified behavior.

The field of health communication is multifaceted and multidisciplinary. People from a variety of disciplinary backgrounds are involved in health communication: professionals in communication, medicine, psychology, public health, sociology, government, and marketing, among others. It is these people who plan, influence, and evaluate health care policy and are involved in the health decision-making process that will enhance the quality of life for individuals and communities across the globe.

Health communication works best when it is a part of a larger public health initiative. Health communication can influence the public agenda, advocate for policies and programs, stimulate debate and dialogue for health as a priority, encourage social norms that benefit health and quality of life, and promote positive changes in the social, economic, and physical environment. Communication can facilitate better health care at the individual, community, family, and system levels, but it alone cannot deliver facility-based clinical or technical services, counseling, and supplies. For this reason, health communication efforts should be coordinated with other programs to improve quality and access to services, strengthen institutions, and formulate effective policies for the betterment of the public's health.

Health professionals and communication experts concur that the power of health communication lies not just in its ability to raise awareness and educate the public, but rather in its ability to change behavior. True health behavior change is much more complex than simply “getting the message out there.” The first step for any effective health communication effort is to understand the target audience(s)—the motives and environmental influences on individuals and groups.

It is crucial to understand that health communication takes place within a particular context. Public policy, the community and culture, interpersonal factors, societal norms and values, intrapersonal factors, and organizational/institutional factors all play a role in the overall effectiveness of health communication efforts.

An example of the growing interest in health communication is witnessed by the establishment of academic programs at colleges and universities. The first such program that combined the communication expertise of a college with a medical school was the Emerson-Tufts Health Communication Program, which in its initial years offered a joint degree to its students. Programs at Michigan State, Illinois, and Rutgers universities followed. Specific academic publications also added to the credibility of health communication as an accepted academic discipline. *Health Communication* and the *Journal of Health Communication* are two of the premier journals in this area.

The increasing complexity of health communication, including new definitions of health, evolution of new media, and the needs of diverse global audiences, demands broad, interdisciplinary, multisectoral approaches to the health communication field. An Institute of Medicine (IOM) report (*Bridging Disciplines in the Brain: Behavioral and Clinical Sciences*) states that “solutions to existing and future health problems will likely require drawing on a variety of disciplines and approaches in which interdisciplinary efforts characterized not only the cutting edge of research but also the utilization of knowledge.” Other studies have suggested the need for health communication professionals to apply more recent and innovative communication theories, as well as continued efforts to strengthen the links between outreach activities and community-based support groups to ensure sustainable impact.

Better planning, more applicable design frameworks, and state-of-the-art expertise are required to manage these complex, interdisciplinary health communication interventions. Past experience suggests the necessity for integration of communication at the strategic framework and planning level as the best way to maximize the successful use and impact of communication interventions. Unfortunately, a lack of formal training and limited resources often limit the ability to design and to properly manage communication activities in the field. What is called for, given this situation,

are partnerships with universities, training institutions, private sector media, and nongovernmental organizations in meeting the health communication objectives.

Communication has become a mature discipline in the United States, consisting of theories, interventions, processes, competencies, and techniques. Thirty years of investment in organizations and partners who have focused on many facets of communication has helped in the development. Furthermore, behavior change has produced many successes in terms of clients' and consumers' understanding of a variety of health conditions. This includes the use of contraceptives, oral rehydration therapy (ORT), hand and food washing, and condoms to prevent HIV/AIDS and sexually transmitted infections (STIs) as well as improved counseling from family planning/reproductive health (FP/RH) providers.

Much of the success of these programs can be attributed to communication science methodologies, which include formative research (client needs and preferences, political/social/family context), as well as mechanisms for incorporating these into the design, development, and implementation of program design and execution. Health communication activities may be organized into a formal program to share local experiences, provide specialized technical support, and manage resources. We have outlined a few of these ideas in the following sections.

## COMMUNICATION CAMPAIGN FRAMEWORK

When designing health promotion campaigns or materials, health communicators will often use strategic planning tools, which include problem analysis, strategic choices, target audience, behavioral objectives, message development, communication channels, stakeholders, and evaluation. Problem analysis involves detailing what you know about the problem; defining its epidemiology and physiology; understanding the environmental, political, and historical influences; and knowing what resources and additional information are necessary for a successful health communication effort. Formative research—such as surveys, focus groups, and interviews—is often done to gain a better understanding of the target audience for a health message and give insight into areas where positive change can be encouraged.

Many health communication activities are designed with a variety of incentives and disincentives for individuals, providers, institutions, and policymakers. Research

is necessary at every stage of the communication process to support and sustain the desired outcome for health competence. Appropriate communication research can identify ideal strategies for performance incentives at the system or individual level, and also identify the necessary environmental (and in some cases economic) structures that can be enhanced.

Ideally, this research and subsequent application will optimize communication effects and can help to drive message development that will appeal to the target audience and promote positive behavior change. The communication channel(s) used (television, radio, print media, etc.) and stakeholders can also be determined through an exploration of this formative research.

Finally, an evaluation component is an essential part of any health communication strategy. Though the effects on behavior may be difficult to gauge in the short term, intermediate outcomes and analysis of the process are important tools in determining how a health communication intervention is performing, and adjustments can be made accordingly. In addition, this type of accountability can help in securing future funding to sustain and further promote and expand these projects.

## Types of Health Communication

A contaminated food or drug being pulled off the shelf; a chemical spill that threatens a local water source; or the potential health effects of impending biological, chemical, or nuclear terrorism are all examples of times when effective health crisis/risk communication are essential for the public. Preparing for a crisis demands careful planning and an attention to detail for an acute event. Before a crisis occurs, it is recommended that leaders develop a theme or potential goals to be accomplished. This type of communication differs from health education and promotion, which tend to focus on more long-term chronic health problems such as vaccination programs and fortification of foods with folic acid to prevent birth defects. Antismoking and antidrug campaigns are examples of campaigns that might try to focus on behavior change.

## Media Strategies for the Health Professional

Communication is the process of sending and receiving information by mean of a shared language or other symbol system. Decisions made about the source, audience, message, and communication channels all play a role in health communication. Professionals

working in this field will also work out how these various factors interact.

The source of the health communication information is one fundamental determinant of a successful effort. The audience receiving a message will assess the source of information according to its character, trustworthiness, knowledge and expertise, use of goodwill, and charisma. Decisions about character and trustworthiness are made based on a speaker's intent, reliability, and sincerity. A speaker's employment, job title, education, and experience can also influence how the source of a message is perceived. By building and nurturing relationships, effective health communication efforts can also develop goodwill and charisma within an audience. Determination of the target audience is essential when developing health messages and deciding on the sources and communication channels to use. These three components of a health communication effort will be different for different audiences.

Knowledge accumulated about certain populations can help to establish the demographics and characteristics of that population that are important for developing and delivering health messages for behavior change. Finally, feedback from the target audience and evaluation of the communication message and delivery can be invaluable for improving the existing effort, as well as designing and executing future health communication efforts.

### Knowledge Gap Hypothesis

This hypothesis states that as information increases, those with a high socioeconomic status and more education will learn faster and easier than those without education and a high socioeconomic status. This hypothesis predicts that, over time, educated people learn faster, highly publicized topics are learned faster, and knowledge gaps decrease when issues have a high degree of conflict and information is repeated. This knowledge gap does not need to be perpetual, for the following reasons:

- As repetition and conflict increase, the knowledge gap gets smaller (e.g., the idea that safe sex and using condoms can prevent the spread of HIV).
- As more people reach an increased state of literacy, the knowledge gap will also decrease.
- At some point there may also be a ceiling effect where most or all of the people are brought up to a certain level of understanding (e.g., knowledge of the

importance of sanitary conditions and good hygiene in keeping people healthy).

When designing health communication campaigns, organizers will often seek to reduce this gap by paying particular attention to literacy and education levels and addressing language and other barriers to receiving messages. Health communication information also becomes more accessible when messages are designed with social and cultural sensitivity and an idea of the types of technologies that may be necessary for message delivery.

### NEW TECHNOLOGIES AND THE FUTURE OF HEALTH COMMUNICATION

New technologies now facilitate two-way horizontal exchange of information and dialogue through the creation of portals and development gateways. These gateways create platforms for users with the same interests to talk to each other. While not the solution for all those that seek improved access to information, one approach for the creation of "knowledge communities" can be effective. In these communities, program planners, research, policymakers, communicators, and others can acquire information, resources, and tools; contribute their knowledge and experience on specific topics; and share materials, dialogue, and solve problems with those working in the same areas. The result is improved communication, learning, and building of networks and communities of practice around significant development challenges.

Improved communication infrastructure and the development of the Internet and other technologies give local institutions the opportunity to create, publish, and disseminate local information and knowledge, and the ability to access information produced in other countries more quickly and more affordably. The Office of Population has already contributed to improving the capacity of select developing country institutions to use some of the new technologies for information and dissemination. For example, Office of Population programs (e.g., the Population Information Program) began to use and train local institutions in the use of CD-ROM technology more than 8 years ago. As a result, CD-ROMs containing up-to-date information on the latest developments, information practices, and research in the family planning/reproductive health field are produced and currently used by more than 500 organizations in 95 countries.

Institutions' capacity to produce their own CD-ROMs, develop Web sites, and improve their ability to work with new and traditional technologies needs strengthening. In collaboration with missions and regional bureaus, this subresult will provide technical assistance and training to select regional and local institutions and programs to create strategies for information dissemination; develop Web sites and list serves; use search engines; and improve dissemination efforts. Small grants could also be provided to pilot test innovative ways to create, publish, disseminate, and exchange information among an organization's affiliates or between knowledge communities within or across countries.

The public physical and political environments are constantly in a state of flux. There will always be a demand to educate new target audiences about new developments related to health in novel and contemporary ways. Future health communicators can work to maintain and increase the level of knowledge and understanding on both the individual and community levels. Programs that address low-income status and literacy will help to close the knowledge and communication gaps that exist, and future research should give us more insight on the links between knowledge and behavior change. Social marketing and entertainment education are expanding subfields of health communication that borrow concepts from the commercial business sector and the entertainment industry to develop campaigns that advance social causes.

As health communication professionals delve further into the potential of interactive health communication, the capacity of people to access and use health information and support will increase. In addition, there will be a heightened understanding of issues related to health communication and a continuance of high-quality, effective, and responsive information. New futures for the field will emerge as communication professionals and the public embrace new technologies. Improved ways of delivering information and technologies, the use of more interactive and personalized health messages and information, and ties to existing products, programs, and frames of reference also promise to advance the field.

—Scott Ratzan,  
J. Gregory Payne, and Skye K. Schulte

See also HEALTH BELIEF MODEL; THEORY OF PLANNED BEHAVIOR; TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

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## HEALTH DISPARITIES

In 1985, Margaret Heckler, the U.S. Secretary of Health and Human Services at the time, released the *Report of the Secretary's Task Force on Black and*

*Minority Health*, which documented striking disparities in mortality rates for cardiovascular diseases, cancer, diabetes, unintentional injury, liver diseases, and infant mortality for ethnic minority populations. Thirteen years later in 1998, then President Bill Clinton issued an ambitious challenge in a radio address to the nation when he suggested that disparities in health status should be eliminated by the year 2010. The president's call to action was motivated by the frequent finding of persistent ethnic disparities in rates of mortality and morbidity among nearly all of the leading causes of death and disability in the United States.

In its response, the National Institutes of Health (NIH) undertook development of a strategic plan designed to guide research that would address the problem. Disparities were defined as "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States." The six key areas identified in which American ethnic minority populations consistently experience disparities in health outcomes and access to care were cardiovascular disease, infant mortality, cancer screening and management, diabetes, HIV/AIDS infection, and immunizations.

Since 1999, research investigating the determinants of disparities in these conditions has increased considerably. However, group differences in health outcomes persist, and in some cases disparities are progressively widening. Many experts now suggest that complete remediation of the disparities dilemma by the year 2010 is impossible. Rather, without substantial intervention, the available evidence suggests that some groups of Americans may experience disproportionately high rates of disease morbidity and mortality for an indefinite period of time.

This entry describes the nature of ethnic disparities in key health outcomes and discusses selected determinants (primarily social) of disparities in health.

## CARDIOVASCULAR DISEASES

Diseases of the cardiovascular system (CVD) constitute the leading causes of death for American men and women, irrespective of ethnicity. In 1995, CVD resulted in approximately one third of the deaths among Asian Americans/Pacific Islanders, 25% among Hispanic men, 33% among Hispanic women, and one quarter of the deaths among

American Indians/Alaskan Natives. There are marked disparities in CVD in African Americans when compared to Whites. For example, in 1995, mortality rates from CVD were 49% higher among African American men and 67% higher among African American women compared to their White counterparts. African Americans have higher mortality than Whites for coronary heart disease (CHD), the major form of CVD. For other ethnic groups, CVD and CHD mortality rates are similar to or lower than for the White population. Newer, more effective treatments and prevention efforts have led to an overall decrease in CHD mortality. However, while the total CHD death rate declined by 20% (from 1987 to 1995), the decrease was only 13% among Blacks. Compared to Whites in 1995, CHD mortality was 40% lower for Asian Americans but 40% higher for Blacks.

## CEREBROVASCULAR DISEASE

Stroke, one of the leading causes of disability in the United States, disproportionately affects African Americans. Compared to Whites, mortality rates from stroke are almost 100% higher among Black men and 70% higher among Black women. Ethnic disparities are even more pronounced at younger ages; among Blacks and Hispanics ages 20-44, stroke incidence is almost 2.5 times higher compared to Whites. Stroke is the only major cause of death for which Asian American males have higher mortality rates compared to Whites.

## HYPERTENSION

One of the most consistent epidemiological findings is the disproportionately high rate of hypertension prevalence among African Americans, which contributes to the high rates of stroke. While the rate of hypertension is 25% in the overall population, it is almost 40% for African Americans. Among Hispanics, Mexican American men and women are at particularly high risk for hypertension—a finding that has been attributed to the high rates of obesity in this population. Birthplace and location of current residence also both exert a strong effect on hypertension status. Compared to those in other regions, residence in the Southeast is associated with a higher prevalence of hypertension, particularly among ethnic minorities.

## INFANT MORTALITY

Although infant mortality rates have dropped for all groups over the past few decades, ethnic disparities remain. For example, in 1950, the mortality rate of Black infants was almost twice that of White children. In 1995, rates of infant death among Blacks were twice those of Whites as well as Hispanics and Asians. This widening disparity in infant mortality is a trend that has persisted over the past 20 years. The rates of infant mortality among Hispanics are roughly equal to those of Whites, despite the lower overall socioeconomic position of Hispanic Americans. The overall infant mortality rate tends to be higher for children born to teenage mothers, but this is not the case for African Americans. The higher rates of teenage pregnancy in African Americans do not account for the higher than average infant mortality rate.

## CANCER

African Americans have the highest rates of cancer incidence and mortality (approximately 35% higher than for Whites), but disparities extend to other groups as well. Compared to other minority groups, American Indians/Alaskan Natives have the lowest levels of survival from all cancers. From 1993 to 1997, breast cancer rates among Asian American women over age 50 increased approximately 6% each year, while the increase among White women averaged only 1.5% each year. African American women had the slightest increase during this period. Black women are disproportionately more likely to die from breast cancer than are women of any other ethnic group. There are also wide disparities in cervical cancer incidence and mortality. While both Black and Hispanic women are at elevated risk for the condition, Vietnamese American women have a fivefold greater rate of cervical cancer incidence compared to Whites.

African American men have both the highest rates of prostate cancer in the world and the lowest levels of survival. Compared to White men, Blacks are 2 to 3 times as likely to die of prostate cancer, explained partly by diagnosis at a later stage of the disease. Black men are also almost 50% more likely to develop lung cancer, a condition that also affects Native Hawaiian men at higher levels.

Ethnic minorities are less likely to be routinely screened for nearly all cancers. For example, only an

estimated 38% of Hispanic women age 40 years and older have had regular mammogram screening.

## DIABETES

An estimated 2.8 million African Americans are currently diagnosed with diabetes, making them about twice as likely as Whites to be diabetic. This Black-White disparity extends to diabetes mortality, which is approximately 27% higher among African Americans. Compared to Whites, the diabetes prevalence is 2.8 times higher among American Indians and 2 times higher among Hispanics. Interestingly, the Pima population of Native Americans in Arizona has the highest prevalence of diabetes anywhere in the world. Among Hispanics, both Puerto Ricans and those living in the Southwest have the highest rates of diabetes, while Cubans have much lower levels. Almost all groups making up the Asian American/Pacific Islander population have higher rates of diabetes compared to Whites.

## HIV/AIDS INFECTION

Although African Americans and Hispanics comprise only a quarter of the total U.S. population, together the groups accounted for approximately 55% of adult HIV/AIDS cases and fully 82% of pediatric HIV/AIDS cases in 1999.

The disparities are most pressing for women; almost 80% of HIV/AIDS-infected women are ethnic minorities. Most individuals affected by HIV/AIDS contract the condition through heterosexual interaction. However, in 1995, half of all HIV/AIDS cases among African Americans and nearly a quarter of cases among Hispanics resulted from injection drug use. By 1999, HIV/AIDS accounted for almost half of the deaths among African Americans and nearly 20% among Hispanics. HIV/AIDS remains the leading cause of death among African American men ages 25-44.

## IMMUNIZATIONS

Routine vaccinations are important tools in preventing the emergence of more serious health outcomes. Although mandatory requirements for most schools virtually ensure vaccination by age 5, a large proportion of American children receive vaccinations much earlier. Whether a child ages 19 to 35 months has received the recommended vaccinations can be used as



a proxy for access to and utilization of medical care. There are relatively small differences between ethnic groups in immunization rates after controlling for socioeconomic position. However, poor children in all groups are less likely to be current on recommended vaccinations when compared to children in higher socioeconomic strata. Disparities in immunization rates do not exist solely among the young; in 1999, both African Americans and Hispanics over age 65 were significantly less likely to report having received influenza and pneumococcal vaccines.

## SOCIAL AND BEHAVIORAL DETERMINANTS OF DISPARITIES IN HEALTH

Over the past decade, increasing research attention has attempted to elucidate specific determinants and causal pathways linking ethnicity with disparities in health outcomes. It is generally accepted that disparities are not caused by any single factor; rather, a complex set of etiological factors likely promote group differences in health. Because of the consistent strength of ethnic differences in health and the burgeoning rise in genetic research over the past two decades, some have suggested that genetic factors may be a primary underlying cause of health disparities. A purely deterministic genetic explanation, however, has been rejected by a majority of researchers. Although variation in gene expression likely results in increased susceptibility to certain risk factors, it is unlikely that group differences have a sole genetic cause.

Biological factors, however, should not be dismissed as determinants of ethnic disparities. For example, a number of biological variables are believed to be associated with the high incidence of hypertension and diabetes among African Americans. These potential determinants include African Americans' greater salt sensitivity, increased vascular resistance, higher prevalence of left ventricular hypertrophy, increased prevalence of insulin resistance, and hyperinsulinemia.

Most integrative models of disease etiology stress the importance of social, psychosocial, and behavioral factors in disease development, progression, and mortality. That many of the leading causes of death are socially and behaviorally based may be of considerable importance to ethnic minorities, who overwhelmingly experience the most deleterious social conditions.

Factors studied most frequently as possible determinants of health disparities include socioeconomic position, health behaviors, obesity, and

social/psychosocial determinants such as stress, social support, discrimination, and access to health care. Although much of this research has focused on Black-White differences, the number of studies of other groups (particularly Hispanic Americans) is increasing.

## Socioeconomic Position

Socioeconomic position (SEP) reflects an individual's relative and absolute standing in society and may be composed of factors such as income, wealth, educational attainment, occupational status, and neighborhood-level factors (e.g., concentration of poverty, violence, access to resources). The strong inverse association between SEP and health is likely the most robust and consistent finding in epidemiology. In disparities research, a frequent practice is to statistically adjust for SEP and examine whether any residual ethnic group differences remain. This is problematic in part because typical measures of SEP do not adequately capture the complexity of SEP or changes in social standing. Also, ethnicity and SEP may exert both independent and interactive effects on health outcomes. In any case, many ethnic differences in health outcomes persist after controlling for SEP variables. Ethnic minorities of low SEP have poorer health outcomes (in nearly all conditions) when compared to those in higher socioeconomic strata.

Some evidence suggests that among African Americans, ethnicity may be more powerful than SEP in predicting prevalence and mortality from specific conditions (e.g., all-cause mortality, hypertension, infant mortality, and diabetes), but this may not apply to other ethnic minority populations. For example, Hispanic Americans are sometimes found to have better overall health than other ethnic groups, despite their lower SEP. This finding has been termed the "Hispanic paradox" and some have suggested that strong social networks, acculturation, dietary practices, immigration policy, and cultural factors may all buffer the effects of low SEP among Hispanic Americans. This highlights the complex interaction of socioeconomic factors and ethnicity in the prediction of health outcomes.

## Health Behaviors

Health behaviors identified as contributors to group differences in health outcomes include cigarette smoking, alcohol consumption, dietary practices, and

physical activity. Obesity, which is closely linked to dietary practices and physical activity, is also very relevant to ethnic disparities in health. Individual behavioral risk factors are potentially modifiable, and their reduction through primary or secondary prevention efforts is widely considered an important approach to reducing health disparities.

### *Cigarette Smoking*

Rates of cigarette smoking have declined since 1965 when more than half of all Americans were active smokers. In 1997, adult smoking prevalence was highest among American Indians/Alaskan Natives (34.1%) followed by African Americans (26.7%), Whites (25.3%), Hispanics (20.4%), and Asian Americans and Pacific Islanders (16.9%). Gender differences are also apparent in the smoking rates of ethnic minorities. White women have higher smoking rates compared to African American, Hispanic, and Asian American/Pacific Islander women. Although ethnic minorities generally have lower smoking rates relative to Whites, they incur significantly higher rates of mortality from tobacco-related disorders. In addition, there is some evidence that Blacks and Hispanics may respond less effectively to smoking cessation treatments.

A great deal of research has focused on smoking reduction during adolescence, when smoking prevalence is higher among Whites than among Hispanic and African American youth. Although smoking rates have declined significantly among African American youth over the past three decades, recent data suggest that the group's smoking prevalence is rising.

### *Alcohol Consumption*

In addition to the adverse psychosocial effects of heavy drinking, excessive alcohol consumption is a primary risk factor for liver cirrhosis and has been identified as a risk factor for hypertension and other cardiovascular conditions. The data surrounding alcohol intake and CVD are somewhat more complicated, as evidence suggests that moderate alcohol intake actually protects against CVD incidence.

Compared to Whites, Hispanics have higher average levels of alcohol consumption. Men in certain Hispanic subgroups, including Puerto Ricans and Mexicans, have vastly higher rates of alcohol consumption compared to non-Hispanic males. There has

been much popular attention directed to the high proportion of alcoholism among Native Americans, who on average are more likely to engage in heavy drinking compared to other populations. Because biological evidence suggests similar alcohol metabolic rates between Native Americans and other groups, research is increasingly focusing on socioeconomic pressures and cultural practices to explain the association.

### *Dietary Practices, Physical Activity, Overweight, and Obesity*

Overweight and obesity, which result from an excess of calorie intake and insufficient caloric expenditure from physical activity, are important risk factors for many of the leading causes of death in the United States including CVD, diabetes, and some cancers. Recent trends of increasing obesity in both adults and children have led to designation of an "obesity epidemic." African American and Mexican American women have substantially higher rates of obesity than White women. There is also a high prevalence of obesity among Hispanic populations (particularly among second- and third-generation immigrants), American Indians/Alaskan Natives, Native Hawaiians, and Samoans. Regional differences are also present such that southern African Americans and Hispanic Americans in border states have higher rates of obesity than those in other geographic locations. Among women, low SEP predisposes to obesity although this does not account for the ethnic differences.

Although excess weight serves as an overall risk factor for disease, the association of obesity with mortality varies by ethnicity. Several groups, including Asian Americans, may have a greater tendency than Whites toward abdominal obesity, a risk factor for diabetes and some cardiovascular conditions independent of the overall level of obesity.

There may be a genetic contribution to the development of obesity among some groups, though this has been difficult to establish. In any event, environmental factors such as unhealthy nutritional practices and sedentary lifestyles are believed largely responsible for the expression of obesity. Fast food and junk food are cheap, time-effective dietary choices that are far more accessible to many low-SEP minorities than are fruits and vegetables. Similarly, regular physical activity requires time, flexibility, safe neighborhoods, parks and recreational facilities, child care

resources—all of which are less common among ethnic minority communities, particularly those characterized by low SEP.

Dietary factors other than excess calorie intake that have been associated with chronic health conditions include high intakes of saturated fat and cholesterol and sodium and low intakes of fruits and vegetables and dietary fiber. Very little empirical research exists to describe the relation between these nutritional factors and health disparities. Data based on an overall score of dietary quality indicate higher-risk dietary patterns in ethnic minority populations than in Whites, except for Asian Americans. Dietary quality also varies by SEP, improving with education or income. However, ethnic differences in dietary quality may be influenced by cultural practices that are partly independent of SEP.

Low levels of physical activity are a risk factor for chronic disease incidence and recurrence of a number of conditions, independent of their association with obesity. Regular exercise is least common among African Americans, followed by Hispanics and Whites. Asian Americans/Pacific Islanders also have been reported to be more sedentary in comparison to Whites. The only exception to this pattern occurs in Black males ages 18-29, among whom regular exercise is more common, compared to Whites. There is a positive relation between SEP and physical activity among most groups, with the exception of Asian Americans/Pacific Islanders.

## Stress

The notion that chronic stress may exert a deleterious effect on health is not a new one, but the investigation of stress has been complicated by its numerous conceptualizations. Practically, stress has been used as a general descriptor of a latent (or unobservable) force that mediates the relation between more specific determinants (i.e., low SEP, discrimination) and biological and/or behavioral outcomes. Stress has been shown to affect a variety of biological functions. In most cases, ethnic minorities (particularly African Americans) have been shown to be more likely to encounter the most deleterious stress-induced biological outcomes.

Stress has been studied in numerous domains relevant to health disparities. However, much of this work either has not explicitly addressed ethnic differences or has not been designed to test health as an outcome

variable. Many suggest that there is a social class gradient in exposure to chronic stress, such that individuals of lower status are (1) more likely to encounter adverse stressors and (2) less likely to be adequately prepared to manage these demands. Because of their lower relative social standing, ethnic minorities are believed to be at significant risk for suffering from their encounters with chronic stressors. In addition, disadvantaged social status has consistently been shown to moderate the effect of stress on physiological outcomes. However, there has been very little work investigating physiological reactions to stress in groups other than African Americans.

## Social Support

The health benefits of social connectedness with individuals, groups, or communities have been investigated in myriad academic disciplines for many decades. As a result, the terminology used to describe the concept varies widely. Most investigators, however, posit a buffering effect of social support against the negative impact of stress and other determinants of disease. While elevated social support is generally believed to be positive for most groups, it is unclear whether the absence of support is uniformly negative.

There is mounting evidence to suggest that significant ethnic differences in social support exist. Collectively, ethnic minority groups are believed to have higher levels of social support in comparison to Whites. However, the structure and function of these support systems vary widely between groups. While most Hispanic Americans are believed to rely heavily on their familial networks, African Americans have similarly functional systems that are comprised of wide networks of immediate and extended family members, as well as friends and institutions (particularly churches and local community). Among Native Americans/Alaskan Natives, social support is derived primarily from family and community.

There is good evidence to suggest that cardiovascular health risk is lowered among African Americans with high levels of perceived social support. Less is known about the health benefits of social support among Hispanics, although early studies suggest that social support operates in the expected protective direction. The social support benefit on health appears not to be as strong for Asian Americans, although the reasons for these findings are unclear.

## Discrimination

There has been increasing recent interest in investigating discrimination as a determinant of health outcomes among historically marginalized American ethnic groups. The interest in studying racial discrimination emerges from the frequent finding that members of ethnic minority groups (particularly African Americans) and those of low SEP are likely to encounter situations throughout their lives that limit their access to the resources necessary for the maintenance of good health. There has been some debate as to the taxonomical classification of discrimination, but there are at least two broad categories currently under study: institutional and interpersonal discrimination.

Studies examining the impact on minority health of biased institutional practices have only recently emerged. Many of these studies examine how such policies promote residential segregation, particularly in locations characterized by lower SEP and multiple exposures to toxic agents. Other work has examined bias in medical treatment practices, often showing systemic bias against African Americans and other groups.

Most studies have examined the impact of interpersonal discrimination on a variety of health outcomes. It should be noted, however, that studies in this area are concerned with perceptions of discrimination, and generally do not seek to objectively investigate the validity of subjects' claims. The overwhelming majority of these studies have been conducted among African Americans, primarily because of the group's historical exposure to discriminatory acts.

Reports of racial discrimination at work and in everyday life have been associated with increased blood pressure and cardiovascular reactivity. The same has been shown in controlled laboratory experiments examining cardiovascular reactions to vignettes depicting racial provocation. Krieger's seminal study showed that Black-White differences in blood pressure were reduced substantially when encounters with discrimination were adjusted for. Although this work provides preliminary evidence that discrimination may be associated with health outcomes, nearly all authors suggest that more work must be done.

## Access to Health Care Resources

The concept of access refers both to entry to and entry within the system of care. Many investigations

have documented ethnic differences in access to health care. For example, compared to only 14% of Whites, fully one third of ethnic minorities over age 18 do not have adequate health insurance coverage. These ethnic disparities are closely tied to SEP and are often found to decrease significantly after adjustment for socioeconomic factors. Irrespective of ethnic group membership, those of low SEP spend considerably more of their income on medical expenses.

Investigators are increasingly recognizing that myriad factors, comprising political, social, occupational, and individual sources, interact to affect health care access and quality.

Disparities in health care remain even when access is held constant. The 2002 Institute of Medicine publication *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* reported ethnic differences in the treatment of nearly every major health concern. Relative to Whites, Blacks and Hispanics are less likely to receive advanced cardiac procedures and medication, even at the same level of CVD severity.

Ethnic and socioeconomic minority group membership affects the provision of quality care in numerous ways, including communication with providers. In addition to more conventional language barriers, many minorities report feeling as though their providers do not listen to and respond to their unique concerns. Other factors include perceived discrimination, patient's mistrust and refusal of services, diagnostic errors, lack of insurance coverage, and many others.

In summary, there are widespread and persistent ethnic disparities in many major health outcomes. The etiology of these group differences is likely comprised of myriad social, psychosocial, behavioral, and biological factors. Given the multifaceted nature of ethnic disparities, a similarly complex approach to intervention is necessary to remediate their deleterious effects.

—Gary G. Bennett

See also AFRICAN AMERICAN HEALTH AND BEHAVIOR; ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS; ASIAN AMERICAN/PACIFIC ISLANDER HEALTH AND BEHAVIOR; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CULTURAL FACTORS AND HEALTH; DISCRIMINATION AND HEALTH; GENDER DIFFERENCES IN HEALTH; JOHN HENRYISM AND HEALTH; LATINO HEALTH AND BEHAVIOR; SOCIOECONOMIC STATUS AND HEALTH

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## HEALTH LITERACY

*Health literacy* is a relatively new term that emerged in the 1990s; however, consensus has not yet

been reached about its definition. For some, health literacy means the ability to function within health care settings and in relation to health materials. For others, the scope of the term *health literacy* is broader than a focus on the spoken or written word and includes background knowledge, scientific understanding, and/or knowledge of the human body. Still others highlight the ability to access information and to navigate institutions and services. In 1995, the Joint Committee on National Health Education Standards provided a definition that encompassed a broad range of contexts: "the capacity of individuals to obtain, interpret and understand basic health information and services and the competence to use such information and services in ways which enhance health." Healthy People 2010, the U.S. Department of Health and Human Services document establishing health goals and objectives for the nation, defined health literacy as "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions."

Health literacy, though still variously defined, has emerged as an item of interest on the national agenda. Practitioners and researchers in a variety of health fields (including public health, medicine, oral health, mental health, occupational health and safety, environmental health) have a stake in the careful examination and delineation of health literacy skills of the public. The increased attention that health literacy garnered at the turn of the century had, in part, been driven by the findings from the first national assessment of adult literacy in the United States. The National Adult Literacy Survey, conducted in 1992, measured the ability of adults to use the written word for everyday tasks and found that half of U.S. adults have limited functional literacy skills.

## FUNCTIONAL LITERACY

Functional literacy was defined by the National Literacy Act of 1991 as "the ability to read, write, and speak in English, and compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and develop one's knowledge and potential." The National Adult Literacy Survey (NALS) was conducted with a sample of more than 26,000 adults and used materials drawn from everyday life, including health-related items. Both the materials used in the survey and the

tasks the adults were asked to perform were carefully measured for levels of difficulty and complexity. Materials included newspaper articles and editorials, signs and advertisements, and commonly used forms.

Tasks ranged in difficulty as well. Participants were asked to locate a piece of information, match two pieces of information, integrate different pieces of information and derive a finding, formulate an answer by finding needed information, and analyze or interpret statements such as those found in an editorial. The functional literacy test was scored on a 500-point scale. The average adult in the United States scores between 267 and 273 on tests of the ability to use information in prose format, document format, and for basic arithmetic calculations. Thus, the average U.S. adult reader can generally locate and match information but has difficulty integrating or analyzing information with accuracy and consistency. Educational and economic analysts note that the average adult does not quite have the literacy skills required for tasks needed in the workplace and for full participation in the activities of everyday civic life. Fully 47% to 51% of adults have low or limited literacy skills, and a disproportionate percentage of these adults are poor or elderly.

Educators note that reading is part of a complex phenomenon. As people develop literacy, they develop a number of other skills, including reading for meaning as opposed to decoding individual words. They learn to describe with accuracy, to give and understand instructions without relying on face-to-face interactions and a shared context. Furthermore, they develop a working vocabulary and an ability to understand categories and abstract concepts. Linguists and reading experts indicate that literacy influences one's ability to access information and navigate in literate environments. Literacy has an impact on cognitive and linguistic abilities and incorporates a variety of skills such as reading, oral presentation, and oral comprehension. Literacy skills are considered to be essential for accessing information and building knowledge.

## LITERACY AND HEALTH

Links between education and health have been well established, but educational status was gathered routinely in health research as a marker of socioeconomic status and had not been examined in terms of key components. For many in public health, the NALS

findings and an expanded understanding of functional literacy had implications for their mandate to inform and, when necessary, alert the public. Those in medicine, needing to engage patients as partners in care and in recovery, were concerned with interpersonal communication and with the consequences of errors. Health practitioners, researchers, and policymakers were troubled by the legal and ethical implications for adequate protection of human subjects, patient autonomy in informed consent procedures, and equal access to care and services. In addition, health literacy's impact on health disparities and on costs was of increasing concern.

## RESEARCH TO DATE

Since the 1970s, most of the studies published in public health and medical journals that mention literacy or health literacy have focused on assessments of the reading grade level of materials used for health purposes such as patient education materials and instructions. Some researchers assessed the readability of materials targeted at specific diseases such as cancer or diabetes; others focused on specific types of materials such as patient package inserts or materials used in institutional settings for emergency department discharge instructions or informed consent. Despite the many kinds of health-related materials analyzed for readability, a clear trend emerges from the literature: The reading level or literacy demands of health materials including educational brochures, directives, forms, documents, and Web postings have been assessed at grade levels calculated beyond high school level and inappropriate for the average adult.

A number of studies, examining both the reading level of materials and the reading ability of the intended audience, found that the literacy demands of the materials exceeded the literacy skills of the readers for whom they were developed. There is growing recognition that a mismatch between the skills of the average person and the reading demands of the written materials developed for the public presents a violation of basic communication principles.

Methodological strides made in the early 1990s, particularly in the development of new tools for rapid literacy measurement in clinical settings, had enabled researchers to move beyond a focus on written materials and explore links between the literacy level of patients and a variety of health outcomes. Although research on the relationship between literacy levels

and poor health status is relatively sparse, examples include inquiries related to the link between literacy and screening behaviors, hospitalization, chronic disease management, and outcomes. For example, studies to date indicate that among people managing a chronic disease, those with limited literacy skills are less informed about the basic elements of their care plan and are less likely to understand and follow the recommended regime than are those with stronger literacy skills. Some studies have shown this disparity through markers such as blood glucose levels in studies of patients with diabetes.

At the same time, people accessing medical, dental, and mental health settings need oral language skills to describe symptoms so that a practitioner can complete a diagnosis. An individual's oral skills and oral comprehension abilities can curtail his or her dialogue with providers. Literacy skills can be further compromised by health-related factors such as illness, pain, stress, and a power differential between patients and providers. Researchers are just beginning to explore these issues.

In addition, all literacy skills are context specific. Health contexts tend to be inundated with scientific terms and the specialized jargon of various specialties. While the literacy skills of individuals are of critical importance, so too are the communication skills of those in the health fields. People's ability to understand print and oral health discussions is related to the clarity of the communication.

Researchers have not yet adequately studied everyday encounters in all of the health-related contexts. Adults are engaged in a wide variety of activities related to health promotion, health protection, disease prevention, and care. As such, they read labels for foods, household goods, and over-the-counter medicines and supplements. They are expected to follow instructions for the use of household and work chemicals and equipment. They monitor their own health and the well-being of others. They are expected to follow directions for minor illnesses, follow-up care, and chronic disease management. They are engaged in civic activities and make decisions related to community and national safety issues, to the environment, and for policy options. Increased health literacy would logically support these activities.

Health literacy represents a new area of inquiry and offers potentials for new discoveries. The exploration of those mechanisms through which literacy may affect health behaviors, health status, service utilization,

and health disparities is vital to the development of effective and appropriate strategies for improving the health of the nation.

—Rima E. Rudd

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## HEALTH PROMOTION AND DISEASE PREVENTION

The field of health promotion and disease prevention emerged out of the recognition that many illnesses and diseases such as cancer, cardiovascular disease, and diabetes are related to lifestyle or environmental factors, for example, dietary intake, physical activity, tobacco use, sunscreen use, and drug and alcohol use. With the discovery that approximately 70% of all premature deaths before the age of 65 could be accounted for by lifestyle and environmental factors, researchers, educators, and clinicians began to investigate behavioral factors in order to improve health and prevent illness. Thus, the field of health promotion and disease prevention emerged as a discipline focused on improving health and preventing illnesses through the investigation of lifestyle or behavioral factors.

The field of health promotion and disease prevention has grown steadily since the publication of the 1974 *Lalonde Report*, which was the first government report to highlight the notion that biology, environment, lifestyle, and health care all affect health status. International efforts that facilitated the development of the field of health promotion include the 1986 International Conference on Health Promotion in Ottawa, Ontario, Canada; the 1992 International Conference on Health Promotion in Santafé de Bogotá, Colombia; and the 1993 First Caribbean Conference of Health Promotion in Port of Spain, Trinidad and Tobago. The subsequent publication of several documents also described international and national initiatives to promote health and prevent disease (i.e., *The Lalonde Report*, *The Ottawa Charter for Health Promotion*, Latin America's *Health Promotion and Equity*, *Caribbean Charter for Health Promotion*, and *Healthy People 2010*). There are numerous objectives to these initiatives, including increasing life span, reducing health disparities, and providing access to preventive services.

Scholars have proposed numerous ways to define the field of health promotion and disease prevention. Definitions of *health promotion* tend to emphasize a combination of educational, political, regulatory, and organizational interventions aimed at improving personal and/or public health and well-being. Whereas the field of health promotion tends to focus on promoting health and increasing well-being, the field of *disease prevention* tends to focus on halting illnesses or diseases, and identifying methods to change risk factors in order to avoid illnesses or diseases. Numerous disease prevention interventions, for example, target smoking as a risk factor for lung cancer.

The field of health promotion and disease prevention grew out of the multidisciplinary field of health education, which tends to use educational principles to improve health and prevent illnesses. However, in addition to using educational principles, health promotion and disease prevention experts also use a number of additional strategies to promote health and prevent illnesses. These strategies include individual or group therapy or counseling, communication and media campaigns aimed at health education, health program development and organizational change, and health policy development and advocacy.

Researchers, educators, and clinicians from various disciplines are committed to improving health and preventing disease through lifestyle or behavioral

modification. *Health educators* study methods and theories to change health behaviors. *Health psychologists* study behavior change and mental processes to understand health and illnesses. *Public health experts*, on the other hand, focus on a broader field than health promotion and disease prevention and tend to conduct population-based health studies (vs. studies on individuals). Public health interventions may also include health assessment and surveillance methods, environment and health policy protection, and health care services.

Health promotion and disease prevention interventions may be developed at the individual, community, organizational, or governmental level. Interventions that focus on individuals tend to target personal knowledge, attitudes, and/or behaviors. Interventions that focus on organizations, communities, or the environment tend to target policies, practices, programs, facilities, or resources. Finally, interventions at the government level tend to target legislation, regulation, and enforcement of health policies. For example, at the individual level, obesity prevention interventions may focus on healthful eating; at the community level, obesity prevention interventions may focus on increasing the accessibility of parks as a strategy for increasing physical activity; at the organizational level, the interventions may focus on increasing healthful eating options and on developing weight control programs; and finally, at the government level, obesity prevention interventions may focus on supporting obesity research and regulating the fast food industry.

Health promotion and disease prevention interventions may be classified into three broad areas: primary prevention, secondary prevention, and tertiary prevention interventions. Primary prevention interventions, such as tobacco awareness and sunscreen use campaigns, are designed to prevent an illness from occurring in healthy people. Secondary prevention interventions, such as mammography screening in women at risk for breast cancer, are designed to identify or treat an emerging illness or disease. Finally, tertiary prevention interventions, such as drug and alcohol abuse treatments, are designed to treat current diseases or illnesses or prevent them from recurring. Regardless of the specific classification of health promotion and disease prevention interventions, it is important to develop assessments and treatments that are effective and culturally appropriate for diverse ethnic, cultural, and socioeconomic status groups.

—Lisa A. Pualani Sánchez-Johnsen



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## HEALTH PSYCHOLOGY

Health psychology is a relatively new subfield of psychology that relates knowledge from all subdomains of psychology to health. A widely accepted definition has been provided by Matarazzo (1982) and was endorsed by the then newly established Division of Health Psychology of the American Psychological Association. Matarazzo stated:

Health Psychology is the aggregate of the specific educational, scientific, and professional contributions of the discipline of psychology to the promotion and maintenance of health, the prevention and treatment of illness, the identification of etiologic and diagnostic correlates of health, illness and related dysfunction, and the analysis and improvement of the health care system and health policy formation. (p. 4)

## CONTENT OF THE FIELD

The broad and rather dry-sounding definition above may come alive by considering a few examples of the work that health psychologists engage in:

- A researcher is interested in the unique compliance problems that diabetic teenagers have, and uses developmental stage knowledge to differentiate compliance issues in teenagers from those of older diabetics.
- A psychologist employed by a general hospital consults with hospital administrators and nursing staff on which surgery patients to place together in a room; this effort stems from observations that patients who are presurgery recover most quickly with the least complications when they share a room with a postsurgery patient who is recovering well (Kulik & Mahler, 1987).
- Psychologists are advising health department officials on how to create effective antismoking advertising that uses knowledge from basic attitude formation research conducted by social psychologists.
- Clinical psychologists with extensive training in psychotherapy apply knowledge of stress reduction techniques to help hypertensive patients bring their blood pressure under control (Linden, Lenz, & Con, 2001).

It may also help to define health psychology by highlighting its definitional overlap and its uniqueness relative to the terms *psychosomatics*, *medical psychology*, and *behavioral medicine*. A quick review of scientific journals that have these terms in their title reveals that many health- and psychology-related topics are equally covered in all these journals. High-profile journals in the field are *Health Psychology*, *Psychosomatic Medicine*, *Psychological Medicine*, and *Annals of Behavioral Medicine*, to name a few. What differentiates the term and the field of health psychology from these others, however, is first, the emphasis on it being unmistakably delineated and labeled as a subfield of psychology rather than another discipline, and second, the stress is on health rather than illness, which, in turn, is more readily linked to medicine (it would be unfair to say that medicine is inherently not interested in health, but tradition has made it a more reactive discipline that is expected to solve existing problems rather than focus on various types of prevention). A third distinction is that the term health psychology sends a broad invitation to contribute to all subspecialties of psychology, whereas the more medically sounding labels tend to presume that "health psychologists" have clinical training and know their way around hospitals.

Finally, one needs to recognize that undergraduate courses and the accompanying textbooks usually represent the first organized exposure to a new field and as such define the field simply by what topics they include and how they are organized. A survey of

popular textbooks indicates that almost all of them have chapters on these topics:

- History of and models in health psychology
- Research methods in health psychology
- A review of relevant physiological systems
- Prevention
- Stress and health
- Effectiveness of psychological interventions for health problems
- Health behavior
- Illness behavior
- Patient-practitioner interaction
- The patient in the hospital
- Adherence to prescribed treatment regimes
- Psychology and nutrition and exercise
- Pain
- Coping with chronic disease
- Death and dying

## HISTORY AND PREVAILING MODELS

The most elementary and oldest concept that marks health psychology is that of a holistic understanding of mind and body that can be traced back to Oriental physicians around 2600 B.C. and Greek philosophers, particularly Hippocrates. More modern thinkers have criticized the traditional medical model that has evolved since Hippocrates as being overly narrow and organ-focused. Particularly influential has been Engel's (1977) critique of the medical model and the proposition of a model that considers the joint and interacting roles of biological, environmental, social, and psychological influences on health and disease. Additional landmarks in the history of health psychology have been (1) the establishment of Division 38 of the American Psychological Association; (2) the creation of the division's "house journal," *Health Psychology*; and (3) the publication of the first undergraduate textbook in health psychology (Feuerstein, Labbe, & Kuczmierczyk, 1986).

—Wolfgang Linden

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## HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY

### EPIDEMIOLOGY

It has long been assumed that the emotional distress (depression/anxiety/irritability) commonly observed in coronary heart disease (CHD) patients is a "natural" reaction to the diagnosis. This is an erroneous, harmful, and expensive assumption. It is now clear that, for large numbers of patients, emotional distress predates and predicts the onset of CHD. For those who do not have premorbid emotional distress, reactive depression/anxiety (and anger) will still adversely affect the progression of atherosclerosis, ischemic episodes, myocardial infarction (MI)/death, noncompliance, symptoms, and utilization.

Major depression occurs in 18% to 20% of CHD patients (a fivefold increase over general population levels), and "minor" depression (dysthymia or adjustment disorder with depressed mood) occurs in another 10% to 15% (also a fivefold increase over general population levels). The distinction between major (per *DSM-IV* criteria) and minor depression (Beck scores of 10 or greater) has not been found to be useful

in terms of predicting MI and death over the first 6 months post-MI, and minor depression is actually superior at predicting mortality over the first 18 months post-MI, in part because it captures all major depressive patients as well. In the available studies, depression appears to be the most potent predictor of mortality over the first 6 to 18 months post-MI, and anxiety appears to be the most potent predictor of CHD mortality in initially healthy populations. However, when patient denial/minimization is circumvented, anger appears to be the best predictor of early onset CHD, particularly in males.

Noncardiac chest pain may occur in up to 50% of CHD patients, betokening widespread panic-like events. Beitman has, in fact, proposed the term “non-fear panic attacks” to describe those events where patients have many of the physical symptoms of panic but deny subjective anxiety/fear. Anger, depression, and anxiety are very strong predictors of morbidity/mortality, with risk ratios often larger than those observed for traditional risk factors such as hypercholesterolemia, hypertension, and smoking. Other outcomes of clinical interest have also been found to be affected by, or associated with, one or more of these three emotions. These include chest pain, coronary artery disease (CAD), fatigue, utilization, hypertension, and noncompliance with smoking cessation, diabetic, and exercise regimens.

## MECHANISMS

Emotional distress may affect the development and aggravation of CHD via psychophysiological or psychobehavioral pathways. These pathways are not mutually exclusive, and there is, at present, no reason to assume that one pathway is the sole culprit. In fact, available evidence suggests that each pathway is plausible. The behaviorally mediated pathways are so well established that they require little discussion. Evidence is available demonstrating that emotional distress (particularly anger and depression) is a predictor of failure to stop smoking, and both cognitive-behavioral therapy and psychopharmacotherapy increase cessation/maintenance rates. Compliance to pill taking, diabetic regimens, and exercise has also been found to be influenced adversely by emotional distress, although no intervention trials have yet demonstrated improvement results from treatment.

The psychophysiological pathways are also multiple and not mutually exclusive. The acute induction of

ischemia by acute mental stress in patients with documented CAD is well established. These observations are complemented by the increase in sudden death seen during natural experiments such as earthquakes and bombings. These psychologically induced events may be due to induced vasoconstriction, vasomotoric-induced plaque rupture, and/or enhanced platelet aggregability superimposed on a plaque.

Distress-related immunocompetence may be impaired as a result of depression, leading to chronic smoldering infection, and/or chronic, subclinical inflammation may promote plaque growth and/or instability.

The acute induction of ischemia may also help account for the increased chest pain seen in patients with emotional distress (particularly anxiety and depression) and the reduction of chest pain associated with treatment of emotional distress. On the other hand, diminished beta endorphins associated with anxiety and depression may simply make patients hypersensitive to ischemic events.

## DIAGNOSIS

As Appels and others have shown, emotional distress in CHD patients often manifests as “fatigue” or “vital exhaustion” (prolonged sleep onset or nocturnal awakening, chronic tiredness, and/or irritability) rather than classic depression. Because these symptoms are almost always misconstrued as a result of the CHD rather than primary psychological phenomena, they result in more aggressive cardiac treatment rather than referral for psychosocial or psychopharmacological intervention. For example, depression has been found to strongly contaminate New York Heart Association (NYHA) ratings in heart failure.

Screening of CHD patients should take place at the time of initial diagnosis and then periodically as suspected by noncompliance, resting chest pain, chronic difficulties falling asleep, staying asleep, or awakening tired, and chronic fatigue. We recommend the use of the Hospital Anxiety and Depression Scale (HADS) completed by the patient because of its brevity, innocuous content, and easy scoring. Because cardiac patients (particularly males) are prone to denial of emotional distress, self-report alone is inadequate in screening patients. Spouse/friend ratings have been found to be superior to self-report at correlating with CAD severity, age at initial diagnosis, and chest pain at 5-year follow-up. Furthermore,

discrepancies between self and spouse/friend ratings, with the spouse/friend reporting higher levels of distress, is an even stronger correlate of CAD severity and mortality. We use the Ketterer Stress Symptom Frequency Checklist–Revised (KSSFCR) to circumvent denial. By asking the patient to select “someone who knows you well” to complete and return (by mail) a separate screening questionnaire, patient denial is minimized. To date, the KSSFCR is the only normed, standardized, and validated means of achieving this end.

The first task in diagnosis and treatment is to rule out organic causes of “depression.” In CHD populations, this means screening for common comorbid conditions such as sleep apnea, cocaine abuse, and dementia. Because these conditions cause, or mimic, some of the symptoms of depression, they are often misconstrued by patients, families, and physicians alike. Assuming these conditions have been ruled out, several other considerations are important.

Depression is, more often than not, comorbid with elevations in anger/hostility (“irritability”) and/or anxiety (panic attacks, generalized anxiety disorder [GAD], or “worry”). In every single-sample test of the uniqueness or confounding of the negative emotions as predictors of clinical status or outcomes of which we are aware, only one measure emerges as necessary to capture all relevant variance in the outcome variable. Thus, screening for multiple measures is almost certainly unnecessary and, from a cost-effectiveness standpoint, wasteful. As in most medical populations, formal *DSM-IV* criteria are rarely useful. Most cardiac patients present with atypical depression/anxiety manifested as chest pain, disturbed sleep, fatigue, or irritability rather than the usual symptoms of sad mood, crying, hopelessness, guilt, or suicidality. This is most likely due to denial or minimization, as discussed below.

## TREATMENT

Treatment of emotional distress has been found to decrease MI and death, chest pain, continued smoking or relapse, ischemic episodes, and utilization. Although not yet tested in intervention trials, there is reason to believe that treatment will improve compliance to pill taking, diabetic regimens, and exercise.

Obviously, the presence of cocaine abuse or sleep apnea requires referral for treatment focused on these conditions. For drug abuse, it is rarely helpful to

attempt treatment of emotional distress before abstinence is achieved, since much of the patient’s emotionality is attributable to fluctuating levels of psychoactives in the central nervous system (CNS) and will only confuse the cognitive-behavioral treatment. For sleep apnea, idiosyncratic drug reactions can occur.

Exercise is known to reduce both cardiac events and emotional distress. Any patient not already engaged in a regular exercise program should be considered for cardiac rehabilitation.

At the present time, cognitive-behavioral stress management is the best established means of improving cardiac outcomes. Risk reductions for MI and death average about 34%. The use of selective serotonin reuptake inhibitors (SSRIs) is relatively new, but well established as safe. Because the older tricyclic antidepressants caused various anticholinergic side effects (dry mouth, blurred vision, orthostatic hypotension, and lengthening of the QT), clinicians have generally shied away from their use in cardiac populations. More important, the newer SSRIs not only have none of these concerns but have shown exceptional promise in reducing cardiac events. In a case-control comparison, Sauer et al. found MI rates to be reduced by 55% to 65%. This is the same magnitude risk reduction observed for coronary artery bypass surgery in left main CAD. In a small safety and efficacy trial of sertraline (Zoloft), originally unintended to measure cardiac outcomes, these findings appear to be supported. Because of drug-drug interactions for many of the SSRIs, the preferred agents are sertraline (Zoloft) and citalopram (Celexa). Generally low doses (25–50 mg of Zoloft or 10–20 mg of Celexa) are adequate.

In two large trials of cognitive-behavioral treatment, women experienced adverse outcomes as a result of treatment. It may be that sex-specific cognitive-behavioral treatment will prove necessary. But the benefits of SSRIs need to be studied for females.

—Mark W. Ketterer

*See also* HEART DISEASE AND DIET; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND SMOKING; HEART DISEASE AND REACTIVITY; HEART DISEASE AND TYPE A BEHAVIOR

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## HEART DISEASE AND DIET

The relationship between diet and coronary heart disease (CHD) has been a topic of extensive research in clinical and epidemiological studies. In the past two decades, at least 20 prospective cohort studies have examined the relationship between dietary factors and risk of CHD. This entry briefly reviews epidemiological and clinical trial evidence regarding the role of specific dietary factors in the cause and prevention of CHD.

### TYPES OF DIETARY FATS

The classic "diet-heart" hypothesis postulates that high intake of saturated fats and cholesterol and low

intake of polyunsaturated fat increase the level of serum cholesterol, which leads to development of atheromatous plaques and eventually to myocardial infarction. In the seminal Seven Countries Study conducted by Ancel Keys and colleagues (1980), intake of saturated fat as a percentage of calories had strong correlation with coronary death rates across 16 defined populations in seven countries ( $r = .84$ ). Interestingly, the correlation between the percentage of energy from total fat and CHD incidence was only modest ( $r = .39$ ). Indeed, the regions with the highest CHD rate (Finland) and the lowest rate (Crete) had the same amount of total fat intake, at about 40% of energy, which was the highest among the 16 populations. Migration studies have also linked dietary factors and CHD.

In 1973, Kato and colleagues compared CHD incidence rates among three defined Japanese populations living in Japan, Hawaii, and San Francisco. Age-adjusted CHD incidence rates were 1.6 per 1,000 person-years in Japan, 3.0 in Hawaii, and 3.7 in San Francisco. With transition to the United States, mean saturated fat intake as percentage of total energy increased, with the highest intake in San Francisco. These data indicate that the substantial differences in CHD rates among the three areas were probably attributed to changes in diet (especially increase in saturated fat intake) and lifestyle, rather than to genetic factors. However, because multiple factors changed simultaneously, it is not possible to pinpoint specific causal factors.

A number of prospective cohort studies have directly addressed associations between diet fat and risk of CHD, but the results from these studies have been inconsistent due to small size and inadequate dietary measurements. In 1997, Hu and colleagues conducted a detailed prospective analysis of dietary fat and CHD among 80,082 women ages 34 to 59 in the Nurses' Health Study. The study was particularly powerful because of large sample sizes and repeated assessments of diet. In multivariate analyses, a higher intake of trans fatty acids and saturated fat, to a lesser extent, was positively associated with CHD risk, whereas a higher intake of mono- and polyunsaturated fat was associated with a lower risk. Total fat was not significantly related to CHD risk. This study concludes that replacing saturated (found in animal products) and trans fats (found in stick margarine, vegetable shortening, and commercial bakery and deep-fried products) with nonhydrogenated mono- and

polyunsaturated fats (natural liquid vegetable oils) is more effective in preventing CHD than reducing overall fat intake.

Controlled metabolic studies have established that exchanging saturated fat for carbohydrate increases low-density lipoprotein (LDL) as well as high-density lipoprotein (HDL) cholesterol, whereas exchanging mono- or polyunsaturated fat for carbohydrate lowers LDL cholesterol and triglycerides and raises HDL cholesterol. Metabolic studies have also consistently indicated adverse effects of trans fat intake on blood lipids. Trans fatty acids raise LDL cholesterol levels and lower HDL cholesterol relative to natural unsaturated fatty acids. As such, the increase in the ratio of total to HDL cholesterol for trans fat is approximately double that for the same amount of saturated fat.

## CHOLESTEROL AND EGGS

In controlled metabolic studies conducted in humans, dietary cholesterol raises levels of total and LDL cholesterol in blood, but the effects are relatively small compared with saturated and trans fatty acids, and individuals vary widely in the response to dietary cholesterol on plasma levels. Although several studies have found a modest association between dietary cholesterol and risk of CHD, there is little direct evidence linking higher egg consumption, a main source of dietary cholesterol, and increased risk of CHD. The Nurses' Health Study and Health Professionals' Follow-Up Study found no evidence of an overall positive association between moderate egg consumption (up to 1 egg/day) and risk of CHD in either men or women.

## N-3 FATTY ACIDS

A low rate of cardiovascular disease in populations with very high intake of fish, such as Alaskan Native Americans, Greenland Eskimos, and Japanese living in fishing villages, suggests that fish oil may be protective against atherosclerosis. Kromhout and colleagues (Kromhout, Bosschieter, & Coulander, 1985) found in the Dutch component of the Seven Countries Study that men who consumed 30 g of fish per day had a 50% lower CHD mortality than men who rarely ate fish during 20 years of follow-up. The Western Electric Study found that men who consume 35 g or more of fish per day had a 40% lower risk of fatal CHD. In the U.S. Physicians' Health Study, weekly

fish consumption was associated with a 50% lower risk of sudden cardiac death, but in the same cohort, no significant association was observed between fish consumption and overall cardiovascular endpoints. The Nurses' Health Study found about a 30% lower risk of CHD associated with two to four servings of fish per week. The Health Professionals' Follow-Up Study found no overall association between dietary intake of n-3 fatty acids or fish intake and the risk of coronary disease, but there was a nonsignificant trend for a reduction in risk for fatal CHD with increasing fish consumption. Two interventional studies, the Diet and Reinfarction Trial (DART) and the GISSI-Prevenzione trial, have found that increased fish consumption or fish oil supplementation reduces coronary mortality among postmyocardial infarction patients.

## TYPES OF CARBOHYDRATES

That different carbohydrate-containing foods lead to different glycemic responses has led to the development of the concept *glycemic index* (GI), a term first coined by Jenkins and colleagues (1981). GI is a ranking of foods based on the extent that blood glucose rises (the area under the curve for blood glucose levels) after ingesting a test food as compared to a standard weight (50 g) of reference carbohydrate (glucose or white bread).

The GI depends largely on the rate of digestion and rapidity of absorption of carbohydrate. Typically, foods with low degree of starch gelatinization (more compact granules) such as spaghetti and oatmeal and high level of viscose soluble fiber such as barley, oats, and rye have a slower rate of digestion and lower GI values. Physical form of the foods is another important determinant of GI. Whole-grain products with intact bran and germ typically have lower GI values. In contrast, refined carbohydrate-containing foods such as white bread tend to have higher GI values because grinding or milling of cereals removes most of the bran and much of the germ and reduces the particle size, allowing for more rapid attack by digestive enzymes.

The ratio of amylose (straight chain of 50 to 300 glucose molecules) to amylopectin (branched chain of 300 to 5,000 glucose molecules) in food is also an important factor influencing GI values. Foods with a higher ratio of amylose to amylopectin such as legumes and parboiled rice tend to have lower GI

values. This is because the tight compact structure of amylose renders it physically less accessible to enzyme attack and therefore harder to digest, and amylopectin molecules, on the other hand, are larger and more open to digestive enzymatic attack.

The concept of glycemic load (GL; the product of the GI value of a food and its carbohydrate content) has been developed to represent both the quality and quantity of the carbohydrates consumed. Using white bread as the reference, each unit of dietary GL represents the equivalent glycemic effect of 1 g of carbohydrate from white bread. Several large population-based studies have documented an inverse association between dietary GI or GL values and HDL levels and a positive association with triglycerides. Epidemiological studies have found that a higher dietary GL, especially combined with low intake of cereal fiber, significantly elevated long-term risk of Type 2 diabetes. A higher dietary GL has also been associated with elevated risk of CHD in the Nurses' Health Study.

Whole-grain products such as whole wheat breads, brown rice, oats, and barley tend to produce slower glycemic and insulinemic responses than highly processed refined grains. Whole grains are also rich in fiber, antioxidant vitamins, magnesium, and phytochemicals. Epidemiological studies have consistently found an inverse association between whole grain consumption and risk of diabetes and CHD. The Nurses' Health Study observed a 25% lower risk of CHD (nonfatal myocardial infarction and CHD death) among women who ate nearly three servings of whole grains a day compared with those who ate less than a serving per week.

## FIBER

Dietary fiber includes the cell walls of plants and other indigestible components of plants. Soluble fibers (pectins, gums, mucilages, and psyllium) lower total and LDL cholesterol through increased bile acid excretion and decreased hepatic synthesis of cholesterol and fatty acids. Based on a recent meta-analysis of 67 controlled trials, the magnitude of cholesterol-lowering effects of soluble fiber is only modest. For example, ingesting 3 g soluble fiber from oats (three servings of oatmeal) decreases cholesterol by only 2%. However, fiber may have other benefits, including improving glycemic control and reducing hyperinsulinemia. Numerous prospective cohort studies

examined the relationship between fiber intake and risk of CHD and virtually all found an inverse association. In the Nurses' Health Study, for each 10-g increase in total fiber intake, there was about 20% reduction in CHD risk. The strongest association was found for cereal fiber, as opposed to fruit and vegetable fiber.

## ANTIOXIDANTS

A body of epidemiological evidence links intake of vitamin E and reduced risk of CHD. The Nurses' Health Study and the Health Professional's Follow-Up Study demonstrated a lower risk for CHD in the men and women who had higher daily consumption of vitamin E, particularly in those subjects that took vitamin E supplements. The Iowa Women's Study found that dietary vitamin E intake, as opposed to supplement vitamin E, was inversely associated with the risk of death from CHD, but in that study, data on duration of vitamin E supplement use were not available.

Results from clinical trials regarding the effects of vitamin E supplementation on the risk of CVD have been largely disappointing; most of the trials did not find protective effects of vitamin E supplements on CHD among patients with existing heart disease. On the other hand, large prospective cohort studies continue to supply strong evidence that high intakes of carotenoid-rich foods such as fruits and vegetables lower risk of cardiovascular disease. In the most recent analysis of the Nurses' Health Study, each 1-serving/d increase in intake of fruits or vegetables was associated with a 4% lower risk for CHD and a 6% lower risk for ischemic stroke. The discrepancy between observational studies and supplementation trials raises the question whether the antioxidants coming from supplements, in high dose and not part of a balanced mix of antioxidants, function in the same way as those from diet.

## FOLATE

Folic acid and other B vitamins are the primary determinants of plasma homocysteine concentrations, a recognized independent risk factor for CHD. Epidemiological studies have found that higher plasma levels of folate or increased consumption of folate was associated with significantly lower risk of CHD. In 1998, the recommended dietary allowance (RDA) for folic acid was raised to 400 micrograms

per day, more than doubling the previous RDA set in 1989. A multivitamin supplement typically contains 400 mcg of folic acid. Beginning in 1997, flour has been fortified with folate, adding about 100 mcg per day of folate to the average American's diet. Most cold breakfast cereals are also fortified to provide 100 mcg of folate per day. Other good dietary sources of folate include orange juice, spinach, and lentils.

## ALCOHOL

Numerous epidemiological studies have documented an inverse association between alcohol consumption and risk of CHD, in both men and women. In general, consumption of one or two drinks per day has corresponded to a reduction in risk of approximately 20% to 40%. Light to moderate alcohol consumption has also been associated with a lower risk of stroke.

## DIETARY PATTERNS

Instead of looking at individual nutrients or foods, dietary pattern analysis examines the effects of overall diet. Since dietary patterns cannot be measured directly, statistical methods have been used to characterize dietary patterns using collected dietary information. Three approaches have been used in the literature: factor analysis, cluster analysis, and dietary indices.

Factor analysis is a multivariate statistical technique, which, in a dietary context, uses information reported on food frequency questionnaires or in dietary records to identify common underlying dimensions (factors or patterns) of food consumption. It aggregates specific food items or food groups based on the degree to which food items in the dataset are correlated with one another.

In contrast to factor analysis, cluster analysis aggregates individuals into relatively homogeneous subgroups (clusters) with similar diets. When the cluster procedure is completed, further analyses (e.g., comparing dietary profiles across clusters) are necessary to interpret the identified patterns.

A variety of dietary indices have been proposed to assess overall diet quality. These indices are typically constructed on the basis of dietary recommendations. For example, the healthy eating index (HEI) is a single, summary measure of the degree to which a person's diet conforms to the serving recommendations of the

U.S. Department of Agriculture (USDA) Food Guide Pyramid for five major food groups and to specific recommendations in the Dietary Guidelines for Americans. The diet quality index (DQI) is a summary score of the degree to which a person's diet conforms to specific dietary recommendations from Diet and Health.

In 1999, Hu and colleagues conducted the first validation study to test the reproducibility and validity of dietary patterns assessed by a food frequency questionnaire (FFQ). Using factor analysis, they identified two major patterns. The first pattern (labeled the "prudent pattern") was characterized by higher intake of vegetables, fruits, legumes, whole grains, fish, and poultry, while the second pattern (labeled the "Western pattern") was characterized by higher intake of red meat, processed meat, refined grains, sweets/desserts, French fries, and high-fat dairy products. The reliability correlations for the factor scores between the two FFQs were 0.70 for the prudent pattern and 0.67 for the Western pattern. The correlations (corrected for week-to-week variation in diet records) between the FFQ and diet records were 0.52 for the prudent pattern and 0.74 for the Western pattern. In subsequent analyses, they found that the major dietary patterns derived from factor analysis predicted long-term risk of CHD. Specifically, the higher prudent pattern score was associated with a lower risk, whereas the higher Western pattern score was associated with an elevated risk.

## SUMMARY

Cumulative evidence from multiple lines of research indicates that types of fats and carbohydrates are more important than total amounts of fats and carbohydrates in determining risk of CHD. Evidence is now clear that replacing saturated and trans fats with unsaturated fats (including sources of n-3 fatty acids) and substituting whole-grain forms of carbohydrate for refined grains will reduce risk of coronary heart disease. In addition, available evidence strongly supports that a dietary pattern rich in these nutrients is likely to reduce risk of CHD.

—Frank B. Hu

See also HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND REACTIVITY; HEART DISEASE AND SMOKING; HEART DISEASE AND TYPE A BEHAVIOR



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## HEART DISEASE AND PHYSICAL ACTIVITY

Coronary heart disease (CHD) is the leading cause of death in the United States, accounting for over half

of all deaths, with an estimated economic cost of more than \$320 billion per year. Physical inactivity is a risk factor that may be modifiable and could result in significant reductions in the incidence of CHD. Although it was not until 1992 that the American Heart Association declared physical inactivity to be an independent risk factor for the development of CHD, a number of epidemiological studies conducted over the past four decades have demonstrated an inverse relationship between the level of physical activity and the risk of developing CHD. Moreover, it has been consistently reported that approximately 80% of American adults undertake insufficient amounts of physical activity to gain any health benefit. Physical inactivity may also be disproportionately high in women, minorities, and individuals with lower socioeconomic status.

## PRIMARY PREVENTION

Systematic increases in physical activity, which can be performed both in the workplace and during leisure time, consistently improve cardiorespiratory fitness in healthy younger and older individuals. Physical training, that is, dedicated efforts to perform aerobic exercise such as walking, jogging, biking, and swimming, can improve fitness by 15% to 30% after 3 months and may rise by as much as 50% over a 2-year period.

A 1990 meta-analysis of 27 prospective studies in healthy participants showed that sedentary individuals have nearly twice the risk of future CHD as those who are physically active. In addition, it has been shown that active people are not only less likely to have CHD, but compared to their sedentary counterparts, they are also likely to develop less severe heart disease with a delayed onset. Some studies have even found that when compared to those individuals who engage in very high levels of physical activity and who have high levels of fitness, a sedentary or low-activity lifestyle with low fitness levels is associated with up to a sixfold increase in both all-cause and CHD mortality. The reduction in risk associated with physical activity has been observed for both leisure time and work-related physical activity.

Physical activity also is associated with a reduction in CHD risk factors such as hypertension, hyperlipidemia, and diabetes. Other non-CHD benefits include reduced risk of gallbladder disease, increased bone density, and improved psychological functioning. Maintenance of exercise is required to sustain or

improve cardiorespiratory fitness; for example, in healthy physically active individuals, 3 weeks of inactivity results in a 10% reduction in fitness, and 3-12 weeks of sedentary behavior can reduce fitness by about 20%.

Recent data from the Health Professionals' Follow-Up Study (44,452 men ages 40 to 75 years), the Nurses' Health Study (72,488 female nurses ages 40 to 65 years), and the Women's Health Initiative (73,743 postmenopausal women ages 50 to 79 years) all have found an inverse dose-response relationship between self-reported energy expenditure from weekly physical activity (average amount of energy expended per hour per week) and risk of developing CHD in initially healthy individuals. After adjusting for multiple risk factors there was a reduction in CHD of 30% to 50% for those in the highest activity quintile when compared to the lowest activity group. All three of these studies found both the intensity (rate of energy expenditure during an activity) and duration of physical activity to be important determinants in the reduction of CHD risk. Studies that have used objective measures of cardiorespiratory fitness (e.g., assessed maximal oxygen uptake) have tended to show an even stronger association with reductions in CHD events than self-report global measures of physical activity, with 70% reduction in CHD risk for those with the highest physical fitness compared to participants who have the lowest levels of fitness.

The majority of the early epidemiological studies involved primarily middle-aged male participants. However, more recent evidence suggests that older men and women also benefit from increased physical activity. For example, reduced levels of walking in 2,678 men, ages 71 to 93 years from the Honolulu Heart Study, were associated with a twofold increase in CHD, and the Iowa Women's Health Study found, in 40,417 women mean age 62 years, an inverse relationship between physical activity and all-cause mortality measured at 7-year follow-up. The Longitudinal Study of Aging found that in 5,901 individuals age 70 or older, high self-reported levels of physical activity were associated with a 54% reduction in all-cause mortality. In addition, studies have generally shown that even moderate-intensity activity is sufficient to obtain significant health benefits, with those that engage in high-intensity activities showing only modest additional reductions in CHD risk. Research has shown that 30 minutes of exercise every day is associated with a 40% to 50% reduction in risk.

There have been several randomized clinical trials that have shown exercise to improve standard CHD risk factors, such as blood pressure and cholesterol levels, and surrogate markers of disease, endothelial function and left ventricular structure, for example. However, to our knowledge, there have been no trials that have assessed the effects of primary prevention physical activity on mortality or other hard clinical CHD end points.

## SECONDARY PREVENTION

Chronic exercise training is associated with improvements in cardiorespiratory fitness and functional capacity in patients with established CHD. Twelve weeks of aerobic exercise 30 minutes, three times a week at a moderate intensity (60-85% maximal capacity) is usually sufficient to improve aerobic fitness, enhance functional capacity, and increase the aerobic threshold, which are usually what limit patients' ability to perform the normal activities of daily life.

There have been more than a dozen randomized controlled trials of exercise in CHD patients. In a 1988 meta-analysis of trials involving nearly 4,500 post-myocardial infarction (MI) patients, 6 weeks of moderate-intensity exercise (30-40 minutes at 65-75% of maximum  $\text{VO}_2$ ) was found to reduce 3-year all-cause and CHD mortality by 25%, when compared to control groups of patients who did not exercise. However, when considered individually, the majority of intervention trials fail to find a significant reduction in long-term outcome for those that participated in exercise compared to a nonexercising control group. These data are further complicated by the lack of trials that focus only on exercise and not on multifactorial cardiac rehabilitation, the high prevalence of men (80%), and the relatively young age of the population (< 65 years old). These studies also were conducted before thrombolytic therapy, coronary-stenting, and treatment with angiotensin-converting-enzyme inhibitors,  $\beta$ -blockers, and statins were widely used. A recent report from the British Regional Heart Study, however, supports the findings of the meta-analysis in that walking at least 4 hours per week, in an elderly (age = 63 years old) sample of 772 men with CHD, was associated with a 5-year reduction in all-cause and cardiovascular mortality of 55% and 59%, respectively.

Despite the exercise-related reductions in all-cause and cardiovascular mortality, there is no definitive

evidence that exercise is associated with reduced cardiovascular morbidity in CHD patients. None of the reported meta-analyses, controlled trials, or non-randomized trials of exercise have found a significant reduction in nonfatal MI of exercisers compared to nonexercisers.

Increased physical activity in patients with more severe CHD, for example, patients with congestive heart failure (CHF), also appears beneficial. For example, preliminary cross-sectional data in patients with CHF estimated a 100-fold increased risk for MI and a 50-fold increased risk of sudden death in sedentary patients compared to habitual exercisers. Exercise training studies also demonstrate that patients with more severe CHD benefit from exercise. However, sample sizes are limited and there is no conclusive evidence that exercise will reduce long-term mortality in these patients. The ACTION trial is an ongoing multicenter clinical trial of exercise in CHF patients that will address this issue.

In addition to the physical benefits of increased physical activity, improvements in psychological well-being and stress reduction have been seen following participation in an exercise program. Measures of depression, anxiety, emotional distress, self-confidence, social isolation, and quality of life have generally been shown to improve after exercise.

Although exercise appears effective in the reduction of fatal CHD events, a multi-intervention approach including behavioral cardiac risk modification, education, and counseling has been shown to enhance the improvements reported in exercise-only interventions. These other intensive additions also provide added benefit by aiding in the long-term adherence of an exercise program.

## RESISTANCE EXERCISE

In studies of low-risk coronary patients, mild to moderate resistance exercise has been shown to improve both muscular strength and cardiovascular endurance. Resistance training, that is, weight lifting or strength exercises, also maintains or increases muscle mass (which helps with exercise-induced carbohydrate metabolism), improves basal metabolism, and has beneficial effects on bone mineral density and flexibility. Apart from providing variety to an exercise regimen, resistance training can improve performance in a variety of tasks encountered in daily life. As such,

resistance exercise provides a valuable complement to cardiorespiratory exercise.

## RECOMMENDED LEVELS OF EXERCISE

There is still much debate regarding the type, frequency, intensity, and duration of physical activity that confers the greatest health benefits. However, there is no question that being sedentary confers a significant increase in risk in both healthy and cardiac populations. Current guidelines recommend 30-60 minutes of moderate-intensity aerobic exercise (60-75% of maximal capacity) on most, and preferably all, days of the week. This minimum level of physical activity should significantly reduce CHD risk for both healthy individuals and CHD patients. Examples of activities considered to be of moderate intensity include brisk walking (3-4 mph), general calisthenics, home repair work, gardening, and heavy cleaning in the home.

Higher-intensity exercise (70-85% maximal capacity) will result in faster, and potentially larger, improvements in cardiorespiratory fitness. However, the greater tolerance of moderate exercise by patients, and the reduced risk of injury, will likely lead to better long-term adherence. Recommended levels of resistance training are 10-15 repetitions, at a moderate to high intensity, for each of 8-10 different exercise sets covering the whole body (arms, shoulders, chest, trunk, back, hip, and legs). These exercises should be carried out at least twice per week.

## RISK OF EXERCISE

For most persons, exercise is a relatively safe activity, but as with the majority of therapies in cardiovascular medicine, there is a small degree of risk associated with exercise. Surveys of supervised exercise programs have found the risk of cardiac arrest to be 1 per 112,000 patient hours of aerobic exercise, nonfatal MI to be 1 per 294,000 patient hours, and sudden cardiac death to be 1 per 784,000 patient hours. In addition, an increased risk of musculoskeletal injury (falls and joint injuries) is associated with increased physical activity; however, these are normally not serious and rarely require medical treatment. These potential risks can be reduced by medical evaluation prior to the onset of a program, an appropriately devised and supervised exercise program, the use of correct equipment, and education about risk management.

## POSSIBLE MECHANISMS OF BENEFIT

Increased physical activity sustained over time results in a reduction of myocardial oxygen demand for any given amount of physical work. This change is due to improvements in oxygen delivery to the muscles (higher maximal cardiac output) and oxygen extraction by the muscles, with the net result being an overall increase in an individual's ability to utilize oxygen. This change has a specific benefit for symptomatic CHD patients, as improved fitness will allow them to achieve a higher level of activity before reaching the level of myocardial oxygen demand that results in myocardial ischemia and angina (chest pain). Other direct benefits of exercise on the heart include increased myocardial function, with some studies showing improvements in cardiac performance following sustained exercise, and increased electrical stability of the myocardium, which is thought to occur due to reductions in sympathetic tone and catecholamine release. In addition to the direct effects that exercise has on the heart, it also modulates many biological domains, and by doing so confers enhanced cardioprotection.

Regular exercise is associated with lower levels of blood pressure and heart rate at rest and submaximal workloads. On average, exercise training can reduce resting systolic and diastolic blood pressure, in cardiac patients, by at least 5 mm Hg. Reduced heart rate and lower blood pressure may be accounted for by reductions in peripheral resistance and a drop in resting catecholamine levels, indicative of reduced sympathetic nervous system activity, following chronic exercise training. This phenomenon also has been reported in healthy individuals and patients with essential hypertension.

Improvements in lipid profile and carbohydrate metabolism have been seen following exercise training. Decreases in plasma triglycerides and low-density lipoproteins, increases in high-density lipoproteins, improved adipose tissue distribution, and beneficial changes in insulin sensitivity all have been observed following increases in physical activity.

The endothelium, the layer of vascular cells that are in direct contact with the blood, has many endocrine, autocrine, and paracrine regulatory functions. Endothelial dysfunction is a key component in the development of atherosclerosis and is prevalent in patients with coronary risk factors (e.g., hypertension, hyperlipidemia, and diabetes mellitus). Emerging

research suggests that endothelial function is improved following participation in aerobic exercise. Recent evidence also suggests that increases in physical activity reduce thrombogenesis, the process of clot formation in the blood. Plasma levels of fibrinogen, the final substrate of coagulation, the clotting process, have been inversely related to activity levels, and beneficial changes in the fibrinolytic (clot dissolution) system and platelet activation, a prothrombotic process, have been observed following chronic exercise. For example, in a study of post-coronary bypass patients, 4 weeks of exercise was associated with improved endothelium-mediated vasodilation, reduced platelet activation, enhanced fibrinolysis, and beneficial changes in plasma viscosity.

Improved autonomic nervous system functioning, as measured by heart rate variability, is associated with higher levels of physical activity and has been shown to improve following exercise training. An imbalance between sympathetic and parasympathetic activity has been shown to increase the risk of cardiac events. Exercise-induced increases in the high-frequency component of the power spectral analysis, which is thought to reflect improved parasympathetic activity, may correct this imbalance and reduce CHD risk.

Exercise also may be associated with other health benefits that may reduce the risk for CHD events including smoking cessation and improvements in clinical depression. This latter finding is important because depression also is a risk factor for CHD events and has been associated with decreased compliance to prescribed medical therapies.

## ADHERENCE

Despite the important health benefits of exercise, long-term adherence to exercise is low. Over 50% of those people who start an exercise program are estimated to stop after 6 months. The issue of adherence is critical because exercise must be maintained for extended periods of time for the health benefits to be realized. Indeed, those who could obtain the greatest benefits from exercise tend to be those individuals who fail to continue exercising.

A number of studies have characterized persons most likely to be nonadherent including demographic, physiological, and psychological characteristics. Demographic variables, such as age, gender, and education, generally fail to distinguish between those

who stop exercising and those who continue to exercise. Physical condition has been found to be an important predictor of continued participation in exercise. Those individuals with greater cardiorespiratory fitness and/or increased muscular strength are more likely to maintain exercise both during and after an exercise intervention. A recent review of behavioral medicine interventions found that higher levels of psychological morbidity and more severe symptoms tended to be related to a higher dropout rate in participants. Social introversion and depression have also been related to premature dropout from cardiac rehabilitation programs. It should be noted, however, that there is limited research in this area, especially among elderly populations.

A number of psychological theories have been used to explain exercise behavior. The transtheoretical model of behavior change recently has been applied to the study of exercise behavior. This model postulates that changes in behavior occur in the following stages: precontemplation, contemplation, preparation, action, and maintenance. The stages of change model is both dynamic and stable, as individuals can move back and forth between the stages before developing a stable behavior pattern. This model allows for potential barriers and causes to differ in relative importance within each stage, which means that particular interventions can be tailored to match the corresponding causes of behavior at a specific stage.

For those individuals who participate in structured exercise programs, simple strategies, such as printed reminders, phone calls, involvement of family and/or friends, logistical assistance (e.g., transport and child care), and added incentives (e.g., reward system where participants can obtain T-shirts, pens, or other such goods), may be sufficient to sustain participation. However, in some cases more intensive methods may need to be employed. One potential way in which adherence can be improved is by using motivational interviewing. Motivational interviewing is an approach to the assessment and intervention based on the stages of change model that is designed to identify and reinforce individuals' personal self-motivating statements and reasons to change behavior. This approach to health promotion interventions emphasizes the use of individualized risk appraisal, identification of potential risk reduction strategies, techniques to increase self-efficacy for behavior change, and strategies to prevent relapse and promote retention.

## SUMMARY

Despite the large diversity in populations studied, methodologies employed, and measures of physical activity used, exercise has consistently been shown to be inversely related to CHD risk. Being physically active is associated with approximately a 50% reduction in the incidence of CHD. This beneficial effect of activity is seen in those individuals with and without preexisting CHD and in younger and older men and women. The reductions are independent of exercise-induced changes in known cardiovascular risk factors (e.g., blood pressure, lipid profile, and insulin sensitivity).

Finally, of the nearly 14 million Americans who have CHD, it has been estimated that more than 8.5 million would benefit from exercise. Fewer than 20% of CHD patients who could benefit from cardiac rehabilitation actually participate in such programs. Also, despite the important advantages of exercise, long-term adherence to exercise is low. It has been estimated that more than half of the people who start an exercise program will stop after 6 months. Because exercise must be maintained for extended periods of time for the health benefits to be realized, strategies to increase exercise adoption and retention are needed.

—Simon L. Bacon and James A. Blumenthal

See also HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HEART DISEASE AND DIET; HEART DISEASE AND REACTIVITY; HEART DISEASE AND SMOKING; HEART DISEASE AND TYPE A BEHAVIOR; PHYSICAL ACTIVITY AND HEALTH; PHYSICAL ACTIVITY INTERVENTIONS; PHYSICAL ACTIVITY AND MOOD

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## HEART DISEASE AND REACTIVITY

Longitudinal research indicates that excessive cardiovascular reactivity to stress is an important independent risk factor for the development of heart disease. Cardiovascular reactivity to stress refers to changes in cardiovascular activity (e.g., heart rate, blood pressure) in response to environmental demands, either physical or psychological, challenging or threatening. The term *heart disease* encompasses a variety of cardiovascular diseases, including essential hypertension (high blood pressure), coronary heart disease (coronary atherosclerosis), myocardial infarction (heart attack), and stroke.

Despite significant advances in prevention and treatment, heart disease remains the leading cause of death in the United States. Traditional risk factors for heart disease, such as family history, smoking, obesity, high cholesterol, and diabetes mellitus, predict only a portion of the new cases of cardiovascular disease that develop each year, so there is considerable room for improvement in prediction through the discovery of new risk factors. Psychosocial factors such as environmental stress and certain personality traits (e.g., anger, hostility, competitiveness, dominance, and Type A behavior) have emerged as significant predictors of heart disease. Numerous studies suggest that the pathophysiological link between these psychosocial risk factors and cardiovascular disease may involve excessive sympathetically mediated cardiovascular responses to stress. Going a step further, the "reactivity hypothesis" postulates that excessive cardiovascular reactivity to stress (i.e., cardiovascular hyperreactivity) is an independent marker or mechanism

for the development of cardiovascular disease. This hypothesis has generated considerable research over the past 25 years on individual differences in cardiovascular reactivity to stress and risk for cardiovascular disease, using both clinical and preclinical indicators of disease in populations ranging from children to adults.

## CARDIOVASCULAR REACTIVITY TO STRESS

Just as exercise stress testing provides important information about cardiac function that is not available from a resting electrocardiogram, the assessment of cardiovascular reactivity to stress provides unique information about hemodynamic function that cannot be gleaned from resting measures of blood pressure (BP) and heart rate (HR). Different laboratory stress tasks tend to elicit different patterns of cardiovascular reactivity, a phenomenon known as stimulus specificity. For example, tasks that involve effortful *active coping* (e.g., mental arithmetic, competitive video games, and active avoidance tasks) elicit primarily a *cardiac* response pattern mediated by the sympathetic nervous system (SNS), including increases in HR, myocardial contractile force (the strength of the heart-beat), cardiac output (CO; the amount of blood pumped by the heart in liters per minute), and systolic BP (SBP). In contrast, tasks that involve inhibitory or *passive coping* (e.g., cold stress, mirror tracing, and passive avoidance tasks) elicit primarily a *vascular* response pattern mediated by the SNS, including increases in total peripheral vascular resistance (TPR; the systemic resistance to blood flow through the arteries) and diastolic BP (DBP), along with HR responses mediated by the parasympathetic nervous system (PNS).

Paul A. Obrist, a pioneer in theory and research on cardiovascular reactivity, was perhaps the first psychophysiologist to distinguish between patterns of cardiovascular and autonomic reactivity elicited by active versus passive coping tasks. Nevertheless, as Obrist noted early on, there are substantial individual differences in the magnitude and pattern of cardiovascular responses to stress that cut across different types of tasks. Such individual differences are an important prerequisite in establishing cardiovascular reactivity to stress as a risk factor for cardiovascular disease because heart disease develops only in some individuals.

### Stability and Heritability of Cardiovascular Reactivity to Stress

Given that heart disease develops over a protracted period of time in the context of varying environmental demands, most researchers posit that cardiovascular reactivity to stress must be a relatively stable trait of individuals over time and across various laboratory challenges in order to qualify as a marker or mechanism of cardiovascular disease. Moreover, given that most forms of heart disease have a substantial genetic component, it seems reasonable to posit that individual differences in cardiovascular reactivity to stress must show a substantial degree of heritability.

Numerous studies have documented the stability of individual differences in cardiovascular reactivity to stress over time and different stressors in both children and adults. Estimates of intertask consistency range from  $r = .15$  to  $r = .82$  for various measures of reactivity, with greater consistency occurring across tasks that elicit similar hemodynamic response patterns (e.g., mental arithmetic and video game challenges). Average estimates of the temporal stability for reactivity to various tasks over retest intervals ranging from 2 days to 10 years are  $r = .61$  for HR,  $r = .51$  for SBP, and  $r = .34$  for DBP. In general, the temporal stability of cardiovascular reactivity improves when (a) measures are aggregated across comparable tasks, (b) data are acquired and scored using standardized procedures, and (c) steps are taken to counteract response habituation over repeated testing sessions. Under these conditions, estimates of the stability of cardiovascular reactivity range from  $r = .60$  to  $.85$ . Thus, measures of cardiovascular reactivity to stress are sufficiently stable over time to serve as potential markers or mechanisms of cardiovascular disease.

Twin studies have documented substantial heritability for measures of cardiovascular reactivity to stress, with heritability estimates ( $h^2$ ) ranging from .22 to .81 for HR and BP reactivity to mental arithmetic, video game, and cold stress. In an emerging trend, recent studies have reported associations between cardiovascular reactivity to stress and variations in specific genes that regulate relevant neurotransmitters, hormones, and their receptors.

### Technological Advances in Hemodynamic Assessment

Most research on cardiovascular reactivity to stress has relied on traditional noninvasive measures of

cardiovascular function such as SBP, DBP, and HR. Nonetheless, consistent with Ohm's law, BP responses to stress arise from interactive changes in CO and TPR ( $BP = CO \times TPR$ ). Moreover, HR responses to stress arise from complex interactions between the SNS (accelerative effects) and the PNS (decelerative effects). Fortunately, technological innovations such as impedance cardiography offer reliable and valid noninvasive measures of CO and TPR, as well as valid measures of myocardial contractile force such as the cardiac preejection period (PEP; the time it takes the heart to contract strongly enough to pump blood out to the body during each heartbeat).

Impedance cardiography works by applying a safe amount of radio frequency electrical current across the chest and then sensing the decrease in electrical resistance or impedance that occurs as the heart pumps blood to the body. Impedance cardiographic measures of cardiovascular reactivity to stress exhibit satisfactory temporal stability in children and adults, with retest reliability coefficients ranging from  $r = .49$  to  $.65$  for CO,  $r = .38$  to  $.58$  for TPR, and  $r = .43$  to  $.69$  for PEP. In addition to providing information about cardiac and vascular contributions to BP reactivity, impedance cardiographic measures such as PEP and CO are particularly sensitive to SNS stimulation of  $\beta$ -adrenergic receptors on the heart, which are the primary cardiac receptors for the SNS neurotransmitter norepinephrine and the related adrenal hormone epinephrine. Thus, while the study of BP and HR can be extremely informative, the added dimension of cardiovascular assessment provided by impedance cardiographic measures of CO, TPR, and PEP offers great promise for investigating specific mechanisms of BP control and heart disease risk.

### Cardiovascular Reactivity to Stress and Heart Disease

Studies of the association between cardiovascular reactivity to stress and heart disease have involved both animal models and human populations. Despite some conflicting reports, the evidence shows by and large that excessive cardiovascular reactivity to stress is associated with a number of established risk factors for cardiovascular disease, including sex, race, socioeconomic status, and family history of heart disease, as well as psychological predictors of heart disease such as anger, hostility, competitiveness, dominance, Type A behavior, and depression. Much of this evidence

has come from cross-sectional studies that cannot establish whether cardiovascular reactivity is a marker or mechanism of disease, but these findings have encouraged a remarkable number of prospective studies designed to determine whether cardiovascular reactivity to stress is predictive of future heart disease.

Much of the prospective research on cardiovascular reactivity as a risk factor for heart disease has involved longitudinal studies of children and young adults who are healthy at the time of initial assessment. A focus on children and young adults, rather than cardiac patients and older adults, is an important and appropriate research strategy because heart disease has its origins in childhood and adolescence, but healthy individuals in this age range should have minimal end-organ damage resulting from disease processes. Thus, this strategy permits the identification of factors that are potential causes as opposed to consequences of cardiovascular disease. Moreover, identifying early markers and etiological factors may help identify individuals at risk for heart disease, thereby enhancing early prevention and treatment efforts. Nevertheless, longitudinal studies of heart disease risk in children and young adults require lengthy periods of study before significant numbers of individuals develop clinical disease end points such as established hypertension, coronary heart disease, myocardial infarction, or stroke.

In the meantime, many researchers have resorted to a method of successive approximation by studying the association between cardiovascular reactivity to stress and preclinical indicators of heart disease that are strong predictors of cardiovascular morbidity and mortality, such as pre-hypertensive elevations in blood pressure over a span of a few years, and ultrasound measures of left ventricular mass (a measure of heart size) and carotid atherosclerosis (a measure of clogging in the carotid arteries). Although the study of these intermediate preclinical indicators is an efficient stopgap, it is nonetheless a step removed from establishing a definitive link between cardiovascular reactivity and heart disease.

### **Cardiovascular Reactivity to Stress and Essential Hypertension**

Several important animal models of hypertension have been developed, using primarily genetically vulnerable strains of mice and rats (e.g., spontaneously hypertensive and borderline hypertensive rats).

Animal studies using these models have generally shown that environmental stress can trigger elevations in BP and the development of hypertension, and that SNS activation and cardiovascular reactivity contribute significantly to the etiological process.

A number of human case-control studies have shown that cardiovascular reactivity to stress is exaggerated in patients with essential hypertension and in normotensive people at risk for hypertension, including individuals with a family history of hypertension, individuals with borderline hypertension, and African Americans. This research has focused primarily on cardiovascular responses mediated by the SNS, but recent evidence suggests that additional vasoconstrictive substances such as endothelin-1 and vasodilatory substances such as nitric oxide may contribute to cardiovascular reactivity as well.

Although elevated TPR is the prevailing hemodynamic characteristic of established hypertension, early stages in the development of hypertension may involve increased TPR, increased CO, or a combination of the two. Moreover, these different hemodynamic profiles may occur to different degrees in different subgroups of people at risk for hypertension, such as young African Americans and borderline hypertensives. For example, research suggests that young African Americans tend to show heightened vascular reactivity to stress, whereas young borderline hypertensives (especially males) tend to show heightened cardiac reactivity to stress. The fact that these early hemodynamic profiles somehow shift eventually to sustained elevations in TPR during the development of hypertension reinforces the importance of studying young individuals at early stages of risk in longitudinal investigations.

Over a dozen different laboratories have published more than two dozen longitudinal studies evaluating the association between cardiovascular reactivity to stress in children and adults and the subsequent development of elevated resting BP. Despite some notable failures, more than 75% of these studies have found supportive evidence indicating that excessive cardiovascular reactivity to stress is a significant predictor of later elevated BP and essential hypertension.

Three studies have reported that BP reactivity to the cold pressor test, involving the immersion of a hand or a foot in ice water, predicts the development of essential hypertension in adulthood over a period of 20 years or longer. Using preclinical elevations in resting BP as an intermediate indicator, several studies



have shown that excessive cardiovascular responses to various forms of cold stress (the cold pressor test, cold stress with an icepack on the forehead, and whole-body cold exposure) predict BP elevations in children and adolescents over periods ranging from 1 to 5 years.

Over a dozen studies have shown that cardiovascular hyperreactivity to psychological stress predicts later elevations in resting BP and the development of hypertension. Most of these studies used mental arithmetic tasks or challenging video games to elicit psychological stress. Several studies have found that cardiovascular responses during a competitive video game task predict elevations in resting BP in children and young adults over a period of 1 to 5 years, and one of these studies found that BP hyperreactivity predicted the early development of hypertension in young adults. Likewise, several studies have shown that cardiovascular responses to mental arithmetic stress predict subsequent elevations in resting BP in children and adults, including the development of established hypertension in young borderline hypertensives, over periods ranging from 5 months to 10 years. Other studies have reported positive associations between cardiovascular reactivity and later elevated BP and hypertension using other psychological stressors, such as active shock-avoidance, mirror tracing, and anticipation of bicycle exercise.

In most of these studies, the relationship between measures of cardiovascular reactivity to stress and subsequent BP elevations and hypertension remained significant after controlling for other risk factors for high blood pressure, including initial resting BP, age, sex, race, socioeconomic status, body mass, and family history of heart disease. Thus, measures of cardiovascular reactivity to cold and psychological stress are apparently unique and independent predictors of future elevations in resting BP and the development of essential hypertension.

Studies of cardiovascular reactivity to stress and hypertensive risk have relied almost exclusively on measures of BP reactivity. However, even studies that have included more sophisticated hemodynamic measures of cardiac and vascular reactivity, such as impedance cardiographic measures of CO and TPR, have generally found that measures of BP reactivity were the best predictors of preclinical and clinical elevations in BP. Given that BP responses result from the interactive effects of cardiac and vascular responses ( $BP = CO \times TPR$ ), these findings may signify

that hypertensive risk is greatest when the normal homeostatic balance between cardiac performance and vascular resistance breaks down, so that both CO and TPR increase during stress, thereby generating heightened BP responses.

### Cardiovascular Reactivity to Stress and Coronary Heart Disease

Perhaps the best evidence for the role of behavioral factors in the pathophysiology of coronary heart disease comes from an animal model developed by Jay R. Kaplan, Stephen B. Manuck, and colleagues, using the cynomolgus macaque. This species of monkey engages in complex patterns of social interaction resembling aspects of human social behavior, including the establishment of social status hierarchies. Like humans, these monkeys also develop coronary atherosclerosis, cardiovascular abnormalities, and high rates of myocardial infarction when fed a diet high in saturated fat and cholesterol. Kaplan, Manuck, and colleagues have used threat of capture and disruption of social hierarchies, sometimes in combination with dietary manipulations of saturated fat and cholesterol, to study the impact of psychosocial stress on the development of coronary atherosclerosis in these monkeys.

Several key findings from this elegant work support an association between cardiovascular reactivity to stress and the development of coronary heart disease. First, psychosocial stress, involving exposure to a new social group or the threat of capture by an experimenter, elicited significant increases in HR in most monkeys. Second, there were substantial individual differences in the magnitude of these HR responses to stress. Third, the monkeys that showed the largest HR reactions to threat developed enlarged hearts and the largest atherosclerotic lesions in coronary arteries. Fourth, pharmacological treatment with  $\beta$ -adrenergic antagonists ( $\beta$ -blockers) blocked the HR response to social stress and prevented coronary endothelial injury, particularly at branching sites in the coronary arteries where the greatest degree of hemodynamic stress occurs. Thus, this research demonstrated a positive association between cardiac reactivity to stress and key clinical features of coronary heart disease, and provided important evidence suggesting that  $\beta$ -adrenergic SNS activation and hemodynamic stress in critical arterial segments may contribute to the pathophysiological process.

A substantial number of studies have evaluated the relationship between cardiovascular reactivity to stress and clinical indicators of coronary heart disease in cardiac patients. The clinical indicators have included cardiac events such as myocardial infarction, measures of arterial occlusion determined by coronary angiography, and measures of myocardial ischemia (measures of deficient blood flow and oxygen delivery to the heart) determined by radionuclide ventriculography, echocardiography, or electrocardiography during exercise stress testing. Although some of these studies have failed to find any association between cardiovascular reactivity and clinical indications of coronary heart disease, several studies have reported positive results. For the most part, the positive findings have involved significant associations between clinical outcomes and increases in DBP and TPR during cold or psychological stress.

The Psychophysiological Investigations of Myocardial Ischemia (PIMI) study is an excellent example of a large-scale investigation of cardiovascular reactivity to stress and clinical events in cardiac patients. The PIMI study found that a substantial number of patients with coronary artery disease experienced myocardial ischemia during psychological stress in the laboratory, involving public speaking and the Stroop color-word conflict test, and that these ischemic episodes were associated with increases in TPR. Ischemic episodes in the laboratory also were associated with increases in HR and BP during public speaking, which was generally more provocative than the Stroop test. In contrast, episodes of myocardial ischemia in daily life, as determined by ambulatory electrocardiography, were associated with a different profile of cardiovascular reactivity during public speaking in the laboratory, consisting of increases in myocardial contractile force and CO, but *decreases* in TPR. Although these findings are promising, further research is needed to resolve the discrepancies and elucidate the underlying mechanisms of ischemia in different environments.

Compared to the work on elevated BP and hypertension, there has been relatively little longitudinal research on cardiovascular reactivity to stress and the development of coronary heart disease. Half a dozen longitudinal studies have evaluated the relationship between cardiovascular reactivity to stress in adults and later indices of cardiovascular morbidity and mortality over periods ranging from 3 to 27 years. Various forms of stress have been used in these studies,

including the cold pressor test and a variety of psychological stressors (e.g., mental arithmetic, public speaking, the Stroop test), but all of the studies have relied solely on measures of BP and HR reactivity. The results have been mixed, with about half of the studies reporting that BP reactivity predicted later cardiac events after controlling for other cardiovascular risk factors.

A number of studies have investigated the relationship between cardiovascular reactivity to stress and preclinical indicators of coronary heart disease. The principal preclinical indicators used so far have been ultrasound measures of left ventricular mass (LVM) and carotid atherosclerosis. Increased LVM is strongly predictive of cardiovascular morbidity and mortality, whereas carotid atherosclerosis is moderately associated with coronary atherosclerosis.

Several cross-sectional studies have investigated the relationship between cardiovascular reactivity to stress and LVM in children and adults. The studies with children were conducted in Karen A. Matthews's laboratory at the University of Pittsburgh and Frank A. Treiber's laboratory at the Medical College of Georgia. Both laboratories have included impedance cardiographic measures of cardiac and vascular reactivity as well as measures of BP reactivity. These studies have found fairly consistent evidence of a positive relationship between heightened cardiovascular reactivity to stress, especially vasoconstrictive reactivity, and increased LVM in children. All of the adult studies were conducted in different laboratories and were limited to measures of BP reactivity. The results of these studies were less consistent, although each study reported at least some evidence of an association between BP reactivity and cardiac structure.

In addition to these cross-sectional studies, longitudinal studies of children conducted in Treiber's laboratory have found that cardiovascular hyperreactivity to various forms of physical and psychological stress predicted increases in LVM between 2 and 4 years later. An additional longitudinal study of middle-aged Swedish men found that BP hyperreactivity to physical and psychological stress predicted increases in LVM over a 3-year period. For the most part, the association between cardiovascular reactivity and later LVM in these longitudinal studies remained significant after controlling for factors such as sex, race, body mass, and initial baseline measures.

Two cross-sectional studies and four longitudinal studies of middle-aged adults have examined the

relationship between cardiovascular reactivity to psychological stress and extent of carotid atherosclerosis. One of the cross-sectional studies examined BP reactivity in anticipation of bicycle exercise, using data from the Kuopio Ischemic Heart Disease (KIHD) Study, a population-based epidemiological study of middle-aged men in Finland. The other cross-sectional study investigated BP reactivity to a battery of behavioral challenges in middle-aged, untreated hypertensive men. Both studies found positive associations between BP reactivity and extent of carotid atherosclerosis.

Likewise, all four longitudinal studies found that BP hyperreactivity to psychological stress predicted the development of carotid atherosclerosis in middle-aged men and women over periods ranging from 2 to 4 years. Two of these studies reported longitudinal data from the KIHD study, and found that the progression of carotid atherosclerosis in men over a 4-year period was predicted by a combination of anticipatory BP reactivity and chronic life stress, as measured by job stress in one study and socioeconomic disadvantage in the other. The associations between BP reactivity and carotid atherosclerosis in these studies generally remained significant after controlling for various risk factors and confounds, suggesting that excessive BP reactivity to stress is an independent predictor of this preclinical indicator of coronary heart disease.

Finally, further prospective data from the KIHD study has shown that SBP hyperreactivity in anticipation of bicycle exercise predicted the incidence of stroke in middle-aged Finnish men over 11 years later. The relationship was strongest for ischemic strokes. Adjusting for other risk factors did not alter the predictive relationship, suggesting that SBP reactivity to stress is a promising independent risk factor for stroke and cerebrovascular disease.

#### LINGERING QUESTIONS AND FUTURE DIRECTIONS

The available evidence indicates that excessive cardiovascular reactivity to stress is a useful predictor of heart disease, but several issues remain unresolved. Although these issues are relevant to considerations of cardiovascular reactivity as a marker or risk factor, they are especially relevant to considerations of cardiovascular reactivity as a possible causal mechanism of heart disease.

Many of the longitudinal studies of cardiovascular reactivity to stress and risk for heart disease have used a single stressor to elicit cardiovascular responses, and many studies have assessed reactivity by using a single BP measurement during stress. As already noted, measurement reliability and accuracy generally improve when multiple measurements are obtained over multiple tasks, so many of these studies probably suffered from poor measurement reliability, thereby hampering attempts at replication and generalization in new studies. A thorough evaluation of individual differences in cardiovascular reactivity to stress is likely to require more sophisticated approaches involving multiple cardiac, vascular, and BP measurements obtained repeatedly during a battery of stressors that “covers the waterfront” of stressful experiences that occur regularly in real life.

As noted earlier, heart disease develops over a protracted period of time in the context of varying environmental demands. Therefore, many investigators posit that cardiovascular reactivity to stress in the laboratory should generalize to reactivity in daily life where the disease process unfolds. However, relatively few studies have evaluated the relationship between laboratory assessments of cardiovascular reactivity during standardized tests and ambulatory assessments of cardiovascular reactivity during daily life.

Some of these studies have yielded disappointing results, which some investigators have ascribed to shortcomings in laboratory research. However, there are considerable difficulties and shortcomings in ambulatory research that require attention. Methodological advancements in ambulatory cardiovascular assessment are clearly needed, as are theoretical advancements in the conceptualization of cardiovascular reactivity as a potential mechanism in the development of heart disease. For example, some ambulatory studies have used rather gross or arbitrary distinctions to characterize daily events and situations as stressful or nonstressful (e.g., work vs. home environments). A better characterization of stressful events and situations in daily life, along with development of parallel stressors for use in the laboratory, would likely improve the correlation between ambulatory and laboratory measures of cardiovascular reactivity.

Researchers have used a variety of methods to define cardiovascular responses to stress, including simple gain or change scores (i.e., the difference between stress and baseline periods), baseline-adjusted gain

scores, absolute response levels, peak responses, and average responses. The inconsistent use of such different approaches across studies is problematic. It is unclear whether peak or sustained cardiovascular responses are most significant, or whether the amount of change or the absolute response level is most critical, in the development of cardiovascular disease. Additional research on the topography of cardiovascular responses to stress may be crucial for understanding the association between cardiovascular reactivity and heart disease.

It also is increasingly clear that the “reactivity hypothesis” requires revision and elaboration. For example, there is considerable evidence indicating that repeated exposure to stress attenuates cardiovascular reactivity. It is difficult to reconcile this habituation of cardiovascular reactivity with the strong form of the reactivity hypothesis, which postulates that recurrent activation of excessive cardiovascular responses to stress leads to the development of heart disease. Further research on factors that promote or disrupt cardiovascular reactivity and adaptation to recurrent stress may clarify the role of cardiovascular reactivity in the development of heart disease.

Based on recent longitudinal findings, Kathleen C. Light and colleagues at the University of North Carolina have proposed a “gene and environment modulated reactivity hypothesis.” Briefly stated, they have hypothesized that heightened cardiovascular reactivity to stress is primarily associated with an increased risk of cardiovascular disease in individuals with a genetic vulnerability for heart disease and/or high exposure to chronic or recurrent environmental stress (e.g., socioeconomic disadvantage, high job stress). Some of the findings from the KIHDS study, reviewed earlier, are consistent with this hypothesis. Personality is also a potential moderator of the association between cardiovascular reactivity to stress and heart disease, as personality plays an important role in determining an individual’s perceptions of and responses to environmental stress. Of course, this revised hypothesis is considerably more complicated than the original version of the reactivity hypothesis, particularly since cardiovascular reactivity itself is influenced by both genetic and environmental factors.

In summary, a proper evaluation of the potential etiological significance of cardiovascular reactivity to stress in the development of heart disease awaits important theoretical and methodological advancements. Fortunately, a number of investigators are

pursuing innovative solutions to these problems. In the meantime, it seems safest to view cardiovascular reactivity to stress as a promising risk factor that may provide useful independent information for the prediction of various forms of heart disease.

—Robert M. Kelsey

See also BLOOD PRESSURE AND HYPERTENSION:

MEASUREMENT; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CARDIOVASCULAR PSYCHOPHYSIOLOGY: MEASURES; CARDIOVASCULAR REACTIVITY; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HEART DISEASE AND TYPE A BEHAVIOR

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## HEART DISEASE AND SMOKING

### THE BURDEN OF HEART DISEASE ASSOCIATED WITH SMOKING

Coronary heart disease (CHD) is the leading cause of death among women (42.3%) and men (38.1%) in the United States. An estimated 1.1 million Americans develop a new or recurrent heart attack each year. Cigarette smoking is one of the most important modifiable risk factors for heart disease. Epidemiological studies indicate that smoking increases the risk of CHD incidence and mortality by a factor of 2 to 3. According to the Office of the Surgeon General, 41% and 45% of CHD deaths among women and men aged less than 65 years, respectively, are attributable to cigarette smoking (U.S. Department of Health and Human Services [DHHS], 1989). The attributable risks for CHD deaths among women and men over the age of 65 are 12% and 21%, respectively. These attributable risks translate into 115,000 CHD deaths each year caused by cigarette smoking.

The risk for CHD rises with the number of cigarettes smoked daily, the total number of years of smoking, the degree of inhalation, and early age at initiation of smoking (DHHS, 2001). There is no discernable threshold of smoking intensity below which increased risk of CHD is not apparent. Regular smokers of as few as 1 to 4 cigarettes per day have been shown to experience a near doubling in the risk of CHD compared with never smokers (Kawachi et al., 1994). Cigarette smoking also has been shown to interact with other risk factors, particularly hypertension, elevated serum cholesterol, and diabetes mellitus, to greatly increase the risk of CHD.

Epidemiological and experimental studies have yielded little or no evidence supporting harm reduction for CHD stemming from the use of filtered or "low yield" cigarettes. It is well known that users of these products behaviorally compensate for the reduced yield of nicotine and tar by increasing the amount of cigarettes smoked, by inhaling more frequently and more deeply, or by blocking the air

dilution vents on cigarette filters. Consequently, the intake of toxic tobacco constituents remains unchanged among smokers who switch from "conventional" yield to low-yield cigarettes. Epidemiological studies have indicated no material difference in the risk of CHD among users of conventional cigarettes compared with users of brands advertised as yielding lower levels of nicotine, tar, or carbon monoxide.

Besides CHD, active smoking has been linked to other cardiovascular diseases, including stroke, peripheral vascular disease, and ruptured aortic aneurysms (DHHS, 2001).

### CAUSAL MECHANISMS LINKING SMOKING TO CHD RISK

Cigarette smoking increases the risk of CHD through a combination of acute and long-term pathophysiological mechanisms. In the short term, exposure to cigarette smoke can cause an imbalance between myocardial oxygen supply and demand, coronary artery spasm, increased platelet adhesiveness and aggregation, and a decreased ventricular fibrillation threshold. These acute effects can manifest as coronary ischemia and symptoms of angina, blockage of compromised coronary blood vessels (the most common cause of acute myocardial infarction), and cardiac arrhythmias and sudden cardiac death. In the long term, cigarette smoking contributes to the development and progression of coronary atherosclerosis, which is the pathological thickening and occlusion of the lumen of the coronary blood vessels that predispose them to blood clots (thrombosis) and "heart attack." The likely mechanisms underlying these chronic effects of cigarette smoking on atherosclerosis progression include repetitive injury to the lining of the coronary blood vessels (the endothelium) caused by the toxic constituents of tobacco smoke, as well as long-term metabolic disturbances such as a decreased high-density lipoprotein (HDL)/low-density lipoprotein (LDL) ratio, and abnormalities in the synthesis of thromboxane A<sub>2</sub> and prostacyclin.

Observational evidence has established a link between smoking and the progression of subclinical atherosclerosis, as assessed by noninvasive, B-mode ultrasound measurement of plaque size, vessel wall thickness, and degree of narrowing (stenosis) of the carotid arteries (DHHS, 2001). Furthermore, a dose-response relationship has been demonstrated between

pack-years of smoking and carotid arterial wall thickness. Cessation of smoking appears to slow the progression of atherosclerosis. In turn, subclinical carotid atherosclerosis has been shown to be a marker of future risk of CHD as well as stroke and transient ischemic attacks.

### THE BENEFITS OF SMOKING CESSATION

Longitudinal studies of smoking cessation indicate a substantial (25-45%) reduction in the excess risk of CHD within 1 to 2 years of quitting. However, due to the cumulative, long-term damage wrought by smoking, it takes longer than 2 years for the excess risk of CHD among former smokers to completely revert to the level of never smokers. Current evidence suggests that it takes at least 5 years, and perhaps as long as 10 to 15 years of cessation, for the risk of CHD to completely dissipate. On the other hand, the benefits of smoking cessation for reduced CHD risk appear to be available to smokers regardless of their age at initiation of smoking, age at quitting, intensity of smoking prior to cessation, and overall duration of smoking, as well as the presence of established CHD (Kawachi et al., 1994).

### PASSIVE SMOKING AND CHD RISK

Passive smoking (also referred to as involuntary smoking) refers to the second-hand exposure to side-stream tobacco smoke emitted from the burning end of a lit cigarette. Side-stream tobacco smoke contains the same mixture of toxic compounds as mainstream smoke (the cigarette smoke inhaled by the smoker), but often in higher concentrations due to the incomplete combustion of tobacco. Given that there is no demonstrable lower limit for the toxic effects of cigarette smoke, it is biologically plausible that individuals exposed to side-stream smoke would experience a similar range of adverse effects as active smokers, albeit in smaller doses.

Nearly two dozen cohort studies and case-control studies have now examined the association between passive smoking and CHD risk (DHHS, 2001). Although few of the risk estimates in individual studies were statistically significant, pooled estimates from meta-analyses indicate a significant 30% increase in the risk for CHD with passive smoking. Based on these findings, as well as supporting experimental

evidence on pathological mechanisms, the Office of the Surgeon General has concluded that the association between passive smoking and CHD in smokers is causal (DHHS, 2001). Passive smoking has been estimated to be responsible for an additional 30,000 excess cases of CHD deaths each year in the United States.

—Ichiro Kawachi

See also HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HEART DISEASE AND DIET; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND TYPE A BEHAVIOR; SMOKING AND HEALTH; SMOKING AND NICOTINE DEPENDENCE; INTERVENTIONS; SMOKING PREVENTION AND TOBACCO CONTROL AMONG YOUTH

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## HEART DISEASE AND TYPE A BEHAVIOR

### CHARACTERISTICS AND ASSESSMENT

In the 1950s, cardiologists Meyer Friedman and Ray Rosenman observed that their cardiac patients were more likely to display a specific combination of behaviors called the Type A behavior pattern (TABP) in comparison to individuals without heart disease.

TABP was defined as an action-emotion complex stimulated by certain environmental events, and is characterized by impatience, a tendency toward hostility and aggressiveness, and a heightened sense of time urgency. TABP was also often manifested by facial tension, rapid and impatient speech, tongue and teeth clicking, and expressed or suppressed hostility. A contrasting Type B behavior pattern was characterized by the relative lack of these behavioral characteristics and the tendency toward more relaxed behavior.

Two general methods have been used to assess the presence or absence of TABP: structured interviews and self-report questionnaires. The Structured Interview (SI) method developed by Rosenman and Friedman, and a subsequent videotaped Structured Interview (VSI), are considered the best means of TABP assessment. During the SI, individuals are asked a series of questions such as how they react to waiting in lines, driving in slow traffic, and facing deadlines at work and home. The interviewer evaluates the degree to which feelings of impatience, hostility, and/or competitiveness are expressed, as well as the style of response. Stylistic indications of TABP would include explosive, loud, and rapid speech, and indications of a potential for hostility. The VSI is videotaped so that Type A indicators such as head nodding, rapid eye blinking, hostile facial expressions, and vigorous gestures can be seen. Disadvantages of using the SI and the VSI are the intensive interviewer training that is required, variability due to the interviewer's behavior while interviewing subjects, and the variability in scoring taped interviews.

Several self-report questionnaires have been used in studying TABP, such as the Bortner Rating Scale Type, the Framingham Type A Scale, and the Jenkins Activity Survey (JAS). The disadvantage of such measures, however, is that they rely on self-perceptions, which may not be accurate. Furthermore, individuals may be influenced by the desire to endorse socially admired characteristics. Nevertheless, self-report methods have the distinct advantages of being less expensive and easier to administer than structured interviews, and have proven to predict coronary disease in some studies (see below). Structured interviews are generally preferred over questionnaires because they directly evaluate behavior and have the strongest association with coronary heart disease (CHD).

## EARLY RESEARCH ON TABP ASSOCIATIONS WITH HEART DISEASE

Large-scale epidemiological studies on TABP as a risk factor for heart disease began in the early 1960s. The Western Collaborative Group Study (WCGS) followed 3,524 men, ages 39 to 59 years, with annual follow-ups for approximately 8 to 9 years (Rosenman et al., 1975). Information such as medical history, socioeconomic factors, physical activity, diet, and cigarette smoking was collected, but the particular focus of the study was the measurement of coronary-prone behavior. TABP was assessed using the SI, with the final behavioral rating being made without knowledge of standard risk factors. Three key findings of the WCGS supported the TABP-heart disease association: (1) TABP was an independent risk factor for heart disease, (2) men characterized as Type A had roughly twice the risk of developing heart disease as their Type B counterparts, and (3) the pattern was a good predictor of a second heart attack in men who had already suffered one.

Similar results were found in another large, prospective study, the Framingham Heart Study, which has followed more than 5,209 healthy residents of the town of Framingham, Massachusetts, since 1948 (Haynes, Feinleib, & Kannel, 1980). Participants were between 30 and 60 years of age at the time of enrollment, and included both men and women. Type A behavior in Framingham participants was significantly correlated with the risk of CHD in both men and women. These and subsequent studies offered enough evidence for the National Heart, Lung, and Blood Institute to publish a critical review in 1981 in which a consensus of psychologists and cardiologists concluded that TABP was an independent risk factor for coronary heart disease in middle-aged U.S. citizens in industrialized geographic areas (Review Panel on Coronary-Prone Behavior and Coronary Heart Disease, 1981).

## CONTRADICTORY FINDINGS

Despite these promising early results, the majority of studies conducted since 1979 have not reported a positive relationship between TABP and coronary heart disease. For example, an 8.5-year follow-up of the WCGS revealed that among patients who survived the 24-hour period following a coronary event, Type A

patients had a significantly lower mortality rate than Type B patients. Furthermore, a 22-year follow-up of the WCGS study found that Type A behavior was not predictive of disease progression and that Type A behavior was found to be associated with longer survival in the WCGS cohort. Other studies such as the Multiple Risk Factor Intervention Trial (MRFIT) have also called the cardiovascular significance of TABP into question. From 1973 to 1976, the MRFIT study enrolled 12,866 men between the ages of 35 and 57. The men were free of heart disease at the time of enrollment, but were selected because of their high risk factors, such as smoking status, high blood pressure, and high cholesterol. Type A behavior was also of interest, and was classified by using the JAS and SI methods. Half of the participants received counseling in smoking cessation and diet; all were monitored for heart disease for up to 17 years. No difference in the rates of heart disease development was found as a function of Type A behavior assessed by either the JAS or SI (Shekelle et al., 1985).

It has been suggested that the discrepancy among study outcomes may be due to the methods used to assess Type A in these studies. Friedman and Ghandour (1993) have argued that the detection of TABP, similar to other diseases, cannot be made by either a written or orally administered questionnaire. Nevertheless, TABP investigations have generally employed some type of questionnaire to assess Type A behavior. Other proposed methodological problems are sample bias due to the obvious exclusion of patients with fatal myocardial infarctions, restriction of range when using high-risk groups, and inconsistency in scoring methods to evaluate disease.

Attempting to reconcile contradictory results, some researchers have broken the Type A behavior construct into subcomponents. What most studies have found is that the hostility and anger dimensions of TABP appear to be the most predictive of CHD.

## DISEASE MECHANISMS

Assuming an association between TABP and coronary disease, individuals with TABP may be more vulnerable to heart disease than Type B persons because they have a substantially greater sympathetic nervous system response to stressful or demanding circumstances. This response is characterized by increases in heart rate and blood pressure, and a surge in adrenal hormones. Because Type A people tend to overrespond to challenges, no matter how large or

small, and because they place themselves in a greater number of demanding circumstances, they experience these heightened physiological responses for longer periods of time each day. It has been suggested that the frequent surges of epinephrine and other adrenal hormones, which increase stress in the cardiovascular system, may injure the inner layer (endothelium) of the coronary artery walls, making them more susceptible to atherosclerosis. Studies have also found that Type A individuals tend to maintain high levels of stress hormones throughout the daytime hours—levels that do not decrease until after they have gone to sleep. The deleterious effects of stress hormones on the heart and the arteries are therefore greater in Type A persons.

## TABP MODIFICATION

Modifying Type A behavior can be difficult, particularly in a success-oriented culture that rewards competition and ambition. Behavior modification, relaxation techniques, and biofeedback training have also been successfully used in altering TABP. A multifactor approach, however, may be most beneficial, as demonstrated by the Recurrent Coronary Prevention Project (RCPP; Friedman, Thoresen, & Gill, 1986).

In this study, approximately 900 TABP patients who had suffered a myocardial infarction (i.e., heart attack) were randomly assigned to either a control group or a treatment group. The control group received standard counseling, in the form of group discussions about the importance of diet, exercise, and medication adherence to avoid future cardiac events. In addition to this standard counseling, patients in the treatment group also received counseling designed to modify the beliefs and expectations underlying Type A behavior. More specifically, beliefs about material achievement, being in control, and striving for the approval of others were challenged. Behavioral changes such as talking more slowly and interrupting less were also promoted. After 4 years, there was a 45% lower occurrence of a second myocardial infarction or sudden cardiac death in the group given TABP modification. The RCPP was initially designed to continue for at least 6 years; however, the National Heart, Lung, and Blood Institute insisted that because the researchers had been able to demonstrate that TABP modification significantly prevented coronary recurrences, the TABP modification should be given to the control groups. After 1 year, the percentage of recurrence dropped dramatically in the original control group.



The occupational stress and organizational psychology literature also suggests that in order to reduce Type A behavior and/or hostility, factors such as job demands, time urgency, hostility, job insecurity, and a punitive climate in the work environment need to be modified.

#### CONTRIBUTIONS OF TABP RESEARCH

Although the anger and hostility subcomponents of Type A behavior are now largely considered the “toxic” elements of the construct, the original TABP studies contributed to a new and growing field called behavioral medicine, dealing with the influence of psychological and behavioral factors on health. TABP research resulted in the recognition of the fact that behavioral characteristics can be as influential on the disease process as such traditional factors as high cholesterol and high blood pressure. This subsequently led to decades of fruitful behavioral research, as well as attention to the role of stress and hostility in coronary heart disease.

—David Krantz and Carolyn Phan Kao

See also ANGER: MEASUREMENT; ANGER AND HEART DISEASE; ANGER AND HYPERTENSION; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HOSTILITY AND HEALTH; HOSTILITY: MEASUREMENT; HOSTILITY: PSYCHOPHYSIOLOGY

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## HISPANIC HEALTH AND BEHAVIOR. See LATINO HEALTH AND BEHAVIOR

## HOPELESSNESS AND HEALTH

The accumulating scientific evidence regarding the connections between hope, well-being, and physical health is reviewed briefly in the subsequent sections.

#### HOPELESSNESS AND HOPE

Although there are numerous ways of conceptualizing hopelessness, there is a common underlying theme: Being hopeless means expecting an undesirable future. This negative expectation, which stems from the perception that any further effort is futile, depletes people of the necessary energy to strive toward their life goals. Over the past decades, science has started to uncover the dire consequences of such hopelessness.

In contrast, researchers also have begun to study the positive roles of hope in human functioning. By examining both hopelessness and hope, a clearer picture may be attained as to how these variables influence our mental well-being and physical health. On this point, physician Leonard Sagan (1987) concluded that the recent improvements in overall world health are due to more than just advances in technology: Specifically, he stated that the decline of hopelessness and the rise in hope were the reasons for the declines in worldwide despair and death.

#### HOPE AND HEALTH MAINTENANCE

Research has shown that hopelessness is related significantly to a number of important health markers. It has been implicated in the development of breast cancer, cervical cancer, myocardial infarction, and shorter overall life span. For example, in studies of

women predisposed to cervical cancer, Arthur Schmale and Howard Iker (1971) discovered that hopelessness predicted the presence of cancer in 82% of the participants. There also is compelling evidence that hope has long-term consequences for physical health. In this regard, Susan Everson and her colleagues (1996) found that higher levels of hope were related to fewer biological and behavioral risk factors.

One reason that hope is important in maintaining health is that it leads to more healthy behaviors such as physical exercise; conversely, higher hope is related to the decreased likelihood of unhealthy behaviors such as high-risk sexual activities. C. R. Snyder and his colleagues (Irving, Snyder, & Crowson, 1998) have found that women with higher levels of hope scored higher on a cancer facts test, they were more knowledgeable about their health, and these women reported a greater willingness to do things to improve their health. In addition, if people believe they have the power to influence their health status, they are more likely to take the steps to remain healthy. For example, women who believe in the effectiveness of breast cancer screening procedures are more likely to get screening for themselves. Hence, having hope results in people taking responsibility for their own well-being.

Hopelessness also appears to affect the immune system. The experience of hopelessness has been shown to decrease cortisol levels in the body, thereby impairing the immune system functioning. Thus, with hopelessness compromising their immune systems, people are increasingly likely to develop a host of illnesses.

## HOPE AND HEALTH RECOVERY

Once a person succumbs to illness, hopelessness plays an important part in the recovery process. This relationship has long been known to practicing health care professionals, and the field is replete with stories of how hope made all the difference in the recovery of particular patients. For example, William M. Buchholz (1988) recounted the story of how an oncologist increased the effectiveness of a treatment for metastatic lung cancer merely by arranging the acronym for the drug cocktail to spell H-O-P-E. One possible interpretation for this and other placebo effects in medicine is that they give people hope.

Recently, empirical research has supported what physicians and nurses have long understood regarding hopelessness and health recovery. Susan Swindells and her colleagues (1999) found that hopelessness

correlated with poorer physical functioning in HIV-positive patients. Because it reduces the desire to live, hopelessness can make disease treatment nearly impossible as it leads to a desire for a quick death, especially in terminally ill patients. This lack of will to survive also results in patients being less likely to follow their treatment regimens. In a study of 295 ill patients, for example, A. Srikumar Menon and colleagues (Menon, Campbell, Ruskin, & Hebel, 2000) found that patients with greater levels of hopelessness were less likely to desire life-saving treatments for their illness—hopeless patients being 5 times more likely to refuse required CPR procedures.

In addition, there seems to be a direct link between hopelessness and the ability to survive. For example, in a study of 74 men diagnosed with AIDS, Geoffrey Reed and his colleagues (1994) discovered that the men who realistically accepted the imminence of their deaths lived significantly shorter lives than those who did not have such a realistic view of their condition. Thus, the realistically hopeless men were less likely to survive their illnesses. Furthermore, hopelessness consistently emerges as the strongest predictor of suicide in both children and adults (e.g., Beck & Steer, 1989).

With their positive expectations for the future, higher-hope people are more likely to engage in active coping behaviors, including the adherence to their treatment regimens. Moreover, hope has been beneficial to patients who were being treated for a wide variety of illnesses and injuries such as burns, spinal cord injuries, blindness, and fibromyalgia. In addition, arthritis patients with higher levels of hope have manifested better upper and lower extremity functioning; moreover, higher levels of hope enable people to handle higher levels of distress, including physical pain.

What are the mechanisms by which hopelessness and hope affect the recovery process? One answer to this question pertains to the fact that more hopeful people are more willing to deal directly with their problems. Thus, the belief that one can improve the situation leads to more healthy behaviors. This type of active coping leads to a fighting spirit that, in turn, is related to better adjustment and longer survival periods when dealing with illness.

## ETIOLOGY OF HOPELESSNESS

Given that hope is such a crucial part of our lives, how is it that some people come to lose it? According to C. R. Snyder (1994), hopelessness is a psychological

state in which people arrive at an enduring sense of apathy toward their life goals. Snyder posited that people regress from being hopeful to being hopeless in a series of steps. The catalysts for this demise of hope are profound goal blockages. In other words, when important goals are unattainable for prolonged periods of time, this undermines hope. These goal blockages lead from thoughts of hope to feelings of rage. With time, the rage degenerates into despair, which eventually turns into apathy. Once people no longer care about achieving their life goals, they have reached a state of hopelessness. This hopelessness may appear as depression in some individuals, or as a total lack of emotion in others. Although Snyder argued that hopelessness can occur at any stage in life, from infancy through adulthood, little research has been conducted on this aspect of his theory. Most of the evidence for the various avenues of hopelessness comes from case studies. More research on a wider range of populations is needed.

### INSTILLING HOPE

There is a long history in the medical field of attempting to give hope to patients. Health care providers have used many strategies to elevate the hopes of their patients, ranging from framing things in the best possible light to outright deception. Having hope is considered to be so important that physicians sometimes use deception in order to increase the levels of this powerful motive in their patients. For example, physicians may perform unnecessary procedures to provide the patient with hope for improvement.

Based on his theory of hope, Snyder and his colleagues have developed specific measures to tap the levels of hope in people (see Snyder, 1994), as well as treatment interventions that are aimed at improving the level of hope. This hope therapy is intended to help people to develop clearer goals, to generate many strategies for reaching these goals, to muster the requisite energy to pursue goals, and to interpret goal barriers as challenges rather than threats. Although the theoretical foundation for such interventions is strong, more research is warranted to understand the role of hope in improving physical health.

—C. R. Snyder and Kevin L. Rand

See also DEPRESSION: MEASUREMENT; DEPRESSION: MORTALITY AND OTHER ADVERSE OUTCOMES; DEPRESSION: TREATMENT

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## HOSTILITY AND HEALTH

### HISTORICAL OVERVIEW OF HOSTILITY AND HEALTH

The link between emotions and health, commonly conceptualized as the "mind-body connection," has been known since ancient times. Perhaps the first ever recorded heart attack is described in the Old Testament (1 Sam. 25), circa 1050 B.C. The victim, an important and very rich man called Nabal, was renowned for being "churlish and evil in his doings."

In 1882, Sir William Osler postulated that personality was a risk factor for coronary heart disease. In the late 1950s, Friedman and Rosenman described the Type A behavior pattern, characterized by competition, aggression, and sense of time urgency. The Western Collaborative Group Study team was among the first to report an association between Type A behavior pattern and coronary heart disease in the United States. However, the Type A behavior hypothesis was not confirmed by subsequent investigations, and evidence emerged indicating that particular ingredients of Type A behavior, namely, hostility and unexpressed anger, were the real culprits.

## DEFINITION AND MEASUREMENT

Hostility is a broad multidimensional personality and character trait having attitudinal (cynicism and mistrust of others), emotional (anger), and behavioral (aggression) components. Cynicism refers to a generally negative view of humankind, depicting others as unworthy, deceitful, and selfish.

Hostility has traditionally being measured by the Cook-Medley scale, which contains 50 true-false items. As an example, the Cook-Medley includes the following items: "I think most people would lie to get ahead"; "It is safer to trust nobody"; "No one cares much what happens to you"; "Most people will use somewhat unfair means to gain profit or an advantage rather than lose it"; "I tend to be on my guard with people who are somewhat more friendly than I had expected"; "I have at times had to be rough with people who were rude to me." This instrument was first developed to identify teachers having difficulty with their students and was empirically derived using pre-existing items from the Minnesota Multiphasic Personality Inventory (MMPI). Other validated instruments to measure hostility include the Buss-Durkee Hostility Inventory, the Novaco Anger Inventory, and the Multidimensional Anger Inventory.

## HOSTILITY AS A PREDICTOR OF HEART DISEASE AND POTENTIAL PHYSIOLOGICAL MECHANISMS

There are numerous studies examining hostility as a predictor of coronary heart disease outcomes. In particular, high hostility scores have been found to be related to increased risk of angiographically documented coronary atherosclerosis, essential hypertension,

coronary heart disease incidence, and all-cause mortality. It has also been shown that hostility is a predictor of re-stenosis after coronary angioplasty, of carotid intimal media thickness among healthy postmenopausal women, and of carotid atherosclerosis progression in middle-aged men. In a recent study among young adults in four U.S. metropolitan areas, there was a positive, graded association between hostility measured at baseline (using the Cook-Medley scale) and coronary artery calcification measured using electron-beam computed tomography 10 years later. However, there are also studies reporting no relationship between hostility and coronary heart disease outcomes or between hostility and subclinical coronary artery disease.

To elucidate mechanisms whereby hostility might contribute to coronary heart disease risk, numerous studies have evaluated associations between hostility and social, behavioral, and physiological coronary risk factors in children and adolescents, young adults, and middle-aged persons. Hostility might contribute to the development of coronary atherosclerosis through concomitant unhealthy lifestyle behaviors (i.e., tobacco use, diet, or poor compliance with medications), but also via multiple physiological pathways. For example, a number of recent investigations have found relationships between hostility and casual blood pressure readings, cardiovascular reactivity, blood pressure morning surge, increased platelet activation, and reduced beta-adrenergic receptor responsiveness. Epinephrine is a recognized platelet activator, and hostile individuals tend to show a marked increase of catecholamine during psychological stress. Furthermore, down regulation of the adrenergic receptor has been linked to prolonged neuroendocrine responses to either psychological stressors or chronic stress associated with frequent and prolonged bouts of anger.

Therapy directed at reducing hostility has been shown to reduce the risk of nonfatal re-infarction by more than 50%. Recent evidence suggests that formal cardiac rehabilitation and exercise training programs can reduce hostility and improve quality of life after major coronary events.

## ANGER, A DIMENSION OF HOSTILITY, AND ITS ASSOCIATION WITH HEART DISEASE

Anger is the affective state most commonly associated with myocardial ischemia and life-threatening

arrhythmias. The scope of the problem is sizable: It has been estimated that at least 36,000 (2.4% of 1.5 million) heart attacks are precipitated annually in the United States by anger.

Specific instruments designed to measure anger include the Spielberger Trait Anger Scale, which measures the frequency of feeling of anger, and the Anger Expression Scale, which measures the extent to which feelings of anger are suppressed (anger-in) or expressed (anger-out).

There are numerous studies documenting an association between anger and manifestations of coronary disease, in particular triggering of myocardial infarction. In the Normative Aging Study, a dose-response relation was found between level of anger and overall risk of coronary heart disease. In the Caerphilly study among 2,890 men ages 49 to 65 years living in South Wales, both anger-out and suppressed anger showed associations with incident coronary heart disease that were independent of physiological, psychosocial, and behavioral risk factors. Researchers from the Stockholm Heart Epidemiology Program showed that, during a period of 1 hour after an episode of anger, the risk of myocardial infarction was 9 times higher compared to a control period free of anger. These results were confirmed by the Determinants of Myocardial Infarction Onset Study in the United States, but the investigators showed that the risk of having a myocardial infarction triggered by isolated episodes of anger depended on the level of educational attainment: The risk of myocardial infarction associated with anger was twice as high among those with less than high school education compared with patients with at least some college education.

#### HOSTILITY AND NON-CORONARY HEART DISEASE HEALTH OUTCOMES

Most research on hostility and health has focused on the development and course of coronary heart disease; thus, the epidemiological data relating hostility and other aspects of health are scarce. There are a few published studies on the relation of hostility with glucose metabolism and insulin sensitivity, breast cancer, and elderly suicide.

In a biracial sample, hostility was found differentially related to measures of glucose metabolism in African Americans and Caucasians: It was significantly related to fasting glucose in African Americans and to insulin sensitivity and fasting insulin in

Caucasian subjects. Furthermore, while the relationship of hostility to insulin sensitivity and fasting insulin was partially dependent on body mass index in Caucasians, the relationship of hostility to fasting glucose was unrelated to body mass index in African Americans. A team of Finnish researchers examined the relationship between personality characteristics and the risk of breast cancer among women age 18 years or more, including Type A behavior and an author-constructed measure of hostility. These results indicated no increase in breast cancer risk in relation to Type A behavior and hostility. Elderly suicide is an increasing public health problem. In a recent study, the psychopathological profile of elderly suicidal ideators was characterized by the presence of hostility. The authors speculated that hostility is often accompanied by failure to control impulses, which is an essential characteristic in suicidal behavior.

#### AREAS FOR FURTHER RESEARCH

Since anger and hostility often correlate with other psychosocial factors involving depressive disorder, anxiety, social isolation, interpersonal conflict, job stress, self-control skills, and sense of coherence, an important area for future studies is to assess the degree to which anger and hostility confer increased risk independently of these other psychosocial variables, as well as the potential interactions or synergistic effects between them.

Another area that deserves attention is the possible influence of diet on hostility, particularly n-3 polyunsaturated fatty acids, which are preferentially contained in fatty fish (salmon, tuna, mackerel), n-3 enriched eggs, green leafy vegetables, flaxseed, rapeseed, walnuts, and vegetable oils, principally soybean and canola. In a trial among young adults in Japan, docosahexaenoic acid (DHA, 22:6 n-3) supplementation with fish oil capsules prevented extra-aggression at times of mental stress and lowered resting plasma norepinephrine concentrations by 31%. In another trial, a high fish diet intervention as part of a cholesterol-lowering program resulted in a reduction of aggressive hostility. In an observational study of subjects with a history of impulsive behaviors, plasma DHA was negatively correlated with serotonin and dopamine metabolites in cerebrospinal fluid, suggesting that the dietary intake of DHA may influence neurotransmitter concentrations.

Additional research is warranted to elucidate the effectiveness and anger-reducing interventions in both

the secondary prevention setting (i.e., persons with known coronary disease) and in the primary prevention setting (i.e., persons without known coronary disease).

—Carlos Iribarren

See also ANGER AND HEART DISEASE; ANGER AND HYPERTENSION; ANGER: MEASUREMENT; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; HEART DISEASE AND DIET; HEART DISEASE AND PHYSICAL ACTIVITY; HEART DISEASE AND REACTIVITY; HEART DISEASE AND SMOKING; HEART DISEASE AND TYPE A BEHAVIOR

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## HOSTILITY: MEASUREMENT

The measurement of hostility is an important issue for behavioral medicine researchers and health care practitioners because some studies have found that hostile people are at increased risk of developing physical disorders such as heart disease and high blood pressure. (For a review, see Miller, Smith, Turner, Guijarro, & Hallet, 1996.) Researchers have defined hostility in a variety of ways, but most definitions describe the hostile person as someone who is consistently cynical toward others, expecting them to be untrustworthy, self-interested, and potentially threatening. This perspective emphasizes cognitive aspects of the self by focusing on attitudes and beliefs. However, because hostile attitudes often are accompanied by anger and aggression, researchers frequently conceptualize and measure hostility as a multidimensional pattern of cognitive, affective, and behavioral characteristics. For example, a cynical person who expects to be taken advantage of by others may feel irritated or resentful about the situation. Along similar lines, a hostile, angry person may express those negative attitudes and emotions by yelling or displaying physically violent behavior. Nonetheless, hostile cognitions or attitudes do not necessarily translate into angry affect or behavioral aggression in every setting and the three constructs can be thought of as describing related but distinct domains.

Caution is in order when interpreting studies about hostility and health, because the terms *hostility*, *anger*, and *aggression* sometimes are used interchangeably.

Researchers have taken two main approaches in measuring hostility: behavioral assessments and self-report questionnaires. Both strategies attempt to identify individual differences in the propensity for hostility and the related dimensions of anger and aggression.

### THE BEHAVIORAL MEASUREMENT OF HOSTILITY

One major strategy for the measurement of hostility involves assessing speech behaviors during a laboratory procedure called the Structured Interview (SI). The SI (which initially was developed as a tool for evaluating Type A behavior) involves presenting the participant with a series of planned provocations in an attempt to elicit relevant behaviors. For example, the interviewer rushes and interrupts the participant, abruptly changes topics, and challenges some of the participant's responses. Interviewers are carefully trained so that all interviewees encounter equivalent levels of challenge during the procedure. The SI requires approximately 10 minutes to administer and interviews are audiotaped for later scoring. Two behavioral techniques for scoring hostility from the SI are particularly important: Potential for Hostility (PH) and the Interview Hostility Assessment Technique (IHAT).

Theodore Dembroski and colleagues conceptualized PH as the stable tendency to experience anger across a variety of social situations. PH scores reflected the auditor's impression of the participant's behavior during the SI on three dimensions: hostile content, intensity of response, and interaction style. Someone who showed marked hostile content would report frequent feelings of frustration or irritation during daily activities. The intensity of response category tapped the emphasis and extremity of hostile statements, as well as the use of obscenities, emotionally laden language, and changes in voice volume and tone. Finally, the interaction style dimension captured condescending, arrogant, or uncooperative behaviors displayed during the SI. In samples of patients, people with high PH scores were found to have more advanced coronary artery disease (e.g., Dembroski, MacDougall, Williams, Haney, & Blumenthal, 1985).

John Barefoot, Thomas Haney, and their colleagues and Duke University refined the behavioral assessment of hostility by developing the IHAT. The IHAT combines Dembroski's emphasis on hostile interaction style with a carefully defined behavioral

scoring system. The IHAT focuses primarily on vocal behaviors and tends to disregard the content of the participant's statements, unless that content is communicated in a hostile fashion. IHAT auditors evaluate SI audiotapes one speaking turn at a time. Each speaking turn (or statement uttered by the interviewee) is scored for the presence and intensity of four behaviors: indirect challenge, direct challenge, hostile withhold/evasion, and irritation. An indirect challenge is scored if the participant subtly deprecates the interviewer, often with an annoyed tone. For example, an interviewee might respond by saying, "Of course!" in a manner that suggests that the interviewer's question was foolish. Overtly antagonistic responses (e.g., sarcastically saying, "Haven't we been over that already?") are scored as direct challenges. A hostile withhold/evasion is counted if the interviewee is purposefully uncooperative or refuses to answer a question. Vocal behaviors such as rapid speech, sighs, harsh tone, and explosive emphasis typically are scored in the irritation category. Patients with high IHAT scores have been found to have more severe coronary artery disease than those with lower IHAT scores and this pattern persists even after accounting for the role of traditional heart disease risk factors such as elevated blood lipids and smoking (Haney et al., 1996).

The major advantage associated with measurement systems such as PH and the IHAT is that researchers are evaluating ratings of behavior made by trained observers, rather than people's personal descriptions of whether they consider themselves to be hostile. This is important because hostile individuals may deny or simply be unaware of their interaction style. In other words, a hostile person might not admit to being hostile if asked directly. However, administering and scoring the SI is an expensive and labor-intensive process. In addition, it can be challenging to train auditors to agree with each other in the consistent scoring of hostile vocal characteristics.

### SELF-REPORT HOSTILITY MEASURES

Self-report questionnaires designed to assess individual differences in hostility began to appear in the 1950s. Hostility questionnaires present people with a series of written statements that reflect hostile, angry, and aggressive themes. Respondents record whether they find each item to be self-descriptive, either by circling "true" or "false" or by selecting a number

from a rating scale. Responses then are scored as a numerical index that can be used to study the associations among self-reports of hostility and related behaviors and health outcomes.

Self-report measures always are potentially problematic in that respondents may not rate themselves accurately or honestly. As described previously, this can be troublesome for the measurement of hostility because people may not be able or willing to acknowledge possessing a trait that is socially undesirable. However, the tendency for people to present themselves in unrealistically positive terms can be reduced by assuring respondents that their confidentiality will be protected. Self-report hostility questionnaires are attractive for clinicians and researchers because they are efficient and inexpensive to administer. There are many self-report measures of hostility and related constructs available. (For a review, see Martin, Watson, & Wan, 2000.) Two of the most commonly used questionnaires are the Cook-Medley Hostility (Ho) Scale and the Buss Durkee Hostility Inventory (BDHI).

Historically, the Ho Scale was developed by Walter Cook and Donald Medley (1954), who were attempting to create a questionnaire that would identify people likely to have good rapport with others. The items were drawn from the Minnesota Multiphasic Personality Inventory (MMPI), which is a broad personality scale commonly used by clinical psychologists. The Ho Scale currently is viewed as a measure of hostile interpersonal attitudes, such as cynicism, antagonism, and manipulateness. The Ho Scale became popular among behavioral medicine researchers because some studies found that Ho Scale scores were associated with heart disease and mortality (for a review, see Miller et al., 1996).

The Ho Scale is composed of 50 true or false items and respondents' answers usually are reported as a single composite score. Sample items include, "When someone does me a wrong I feel I should pay him back if I can, just for the principle of the thing" and "I have often met people who were supposed to be experts who were no better than I." Although the Ho Scale has been widely used, questions have been raised about the structure of the measure. Respondents seem to answer Ho Scale items erratically and are inconsistent in endorsing items that appear to be logically related. Nonetheless, Ho Scale scores show meaningful relationships with a variety of health-related variables. People with high Ho Scale scores report high levels of daily stress and negative

mood and low levels of social support; in addition, high Ho Scale scores are related to increases in blood pressure and cortisol (Smith, 1992).

Arnold Buss and Ann Durkee (1957) designed the BDHI to distinguish among several aspects of hostility commonly observed by clinicians conducting psychological assessment and therapy. The 75 true or false items were written to represent seven types of hostility (assault, indirect hostility, irritability, negativism, resentment, suspicion, and verbal hostility); several items also were included that pertained to feelings of guilt. BDHI responses typically are represented as a composite score; subscale scores reflecting the various dimensions also may be reported.

Studies of patterns in the way people answer BDHI items show that responses generally can be grouped into two broad categories: an emotional and attitudinal dimension that reflects the personal experience of angry emotions and thoughts and a motor component that represents overt physical and verbal expressions of anger. Aron Siegman and colleagues (Siegman, Dembroski, & Ringel, 1987) found that people with high scores on the expressive dimensions of the BDHI tended to have more severe coronary artery disease than respondents who described themselves as less likely to express their anger.

Although the BDHI had been widely used by psychologists, Buss eventually came to feel that its items were troublesome for at least two reasons. First, many people have difficulty describing their behavior in simple true versus false terms. Second, several BDHI items seemed to blur the intended distinctions among different facets of hostility. As a consequence, Buss and Mark Perry (1992) refined and extended the BDHI items in a new measure called the Aggression Questionnaire (AQ). The AQ includes four subscales: physical aggression, verbal aggression, anger, and hostility, and careful efforts were made during the construction of the items to avoid overlap among these categories. Consistent with its name, the AQ Hostility subscale relates to attitudinal elements of cynicism and mistrust, with items such as "I am sometimes eaten up with jealousy" and "At times I feel like I have gotten a raw deal out of life." Because the AQ is a fairly new measure, the associations among AQ scores and health outcomes are unexplored.

—René Martin and S. Beth Bellman

See also ANGER: MEASUREMENT; HOSTILITY AND HEALTH



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## HOSTILITY: PSYCHOPHYSIOLOGY

### DEFINITION OF HOSTILITY

Hostility is a multidimensional construct consisting of cognitive, affective, and behavioral dimensions. The cognitive dimension consists of cynicism and mistrust of others. The affective dimension includes feelings of anger, irritation, rage, contempt, resentment,

and bitterness. The behavioral dimension includes various acts of physical and verbal aggression. Researchers are interested in the physiological correlates of hostility because several studies have shown that hostility is a significant risk factor for coronary heart disease (CHD). We will consider evidence regarding the associations of cognitive, affective, and behavioral components to physiology in turn.

### MECHANISMS LINKING HOSTILITY TO CHD

The precise mechanisms through which hostility confers risk for CHD are not known. One hypothesis suggests that repeated, exaggerated, and prolonged activation of the sympathetic nervous system and neuroendocrine components of the human stress response mediates the hostility-CHD relationship. This contributes to poor health in at least two ways. First, over time stress-induced hemodynamic changes (e.g., increased blood pressure, sheer stress, and turbulence) and the increases in catecholamines (i.e., epinephrine and norepinephrine) and other stress-related hormones, such as cortisol, may act to initiate and/or hasten the atherosclerotic process. This is supported by studies that have found stress-induced changes in blood pressure and/or heart rate to be associated with coronary artery disease in cynomolgus monkeys and the progression of carotid atherosclerosis in humans. Second, the acute physiological changes associated with the human stress response may lead to arrhythmias, myocardial ischemia, thrombus formation, and plaque rupture and thus serve as a trigger of heart attacks and sudden death in vulnerable individuals.

### HOSTILITY AND PHYSIOLOGY: CHRONIC EFFECTS

#### The Cook-Medley Hostility Scale and Physiological Reactivity

*Blood pressure and heart rate (laboratory studies).* One of the most commonly used measures of trait hostility is the Cook-Medley Hostility Scale (CMHS). Although the scale contains items that reflect the affective and behavioral dimensions of hostility, a large portion of the items reflect cynicism and mistrust. This scale has been widely used in studies investigating the relation between hostility and physiological reactivity in response to mental and social stress. Physiological reactivity refers to stress-induced changes in physiological measures (e.g., blood pressure,

heart rate, norepinephrine level) from some baseline or resting state. One important finding in this literature is that the relation between hostility and physiological reactivity depends on the characteristics of the task used to elicit mental stress. This was demonstrated by an early study in which male subjects engaged in a challenging anagram task. One half of the subjects were provoked by verbal harassment while they completed the task and the other half were not. The results demonstrated that high CMHS scores were associated with heightened and prolonged diastolic blood pressure, but only for subjects who were provoked and angered. Subsequent studies using samples of both males and females have reported similar findings, although there have been a small number of studies that have failed to find that the CMHS is associated with higher levels of blood pressure and/or heart rate.

*Blood pressure and heart rate (ambulatory studies).* Hostile people not only have greater physiological reactivity in response to interpersonal stress, they also report the experience of interpersonal stress more frequently in their daily lives. It has been hypothesized that hostile people, who are mistrustful and attribute hostile intent to others' behavior, approach or respond to interpersonal situations in ways that create conflict. A limitation to laboratory paradigms is that they do not take into account the frequency in which people experience interpersonal stress during the day. Ambulatory monitoring techniques provide a way to evaluate hostility as a predictor of blood pressure and heart rate during normal daily activities. Because these techniques monitor physiology multiple times over the course of the day, they have the potential to capture subjects' exposure to stressful situations throughout the day.

Several studies using this methodology have provided evidence that high hostile subjects show elevated levels of blood pressure and/or heart rate during waking hours or while asleep. One study found that the CMHS was associated with high systolic blood pressure levels and the perceptions of interpersonal stress partially accounted for the relationship between hostility and systolic blood pressure. Another study found that high hostile men showed higher levels of diastolic blood pressure and heart rate during the day. Furthermore, high hostile subjects showed higher systolic blood pressure, but only in situations in which they were interacting with someone else. Results from

other studies provide further support for the association between the CMHS and ambulatory blood pressure and heart rate.

However, there are some indications that these phenomena may be stronger in men than in women. The use of this methodology can provide compelling evidence for the negative impact of hostility during daily interpersonal stressors.

*Stress hormones.* The focus on blood pressure and heart rate has expanded to include other important indices of the stress response. The CMHS has been associated with heightened levels of norepinephrine and cortisol and poorer recovery in response to laboratory paradigms. It also has been associated with higher urinary cortisol excretion, but only during daytime hours. In addition, there is evidence that hostile people have chronically elevated levels of epinephrine during their daily lives.

*Heart rate variability.* Heart rate variability, an index of parasympathetic nervous system (PNS) function, is another important variable that has received some attention in this literature. High-frequency heart rate variability is thought to reflect PNS modulation of cardiac function and is believed to be an indicator of cardiac health. Lower levels of high-frequency heart rate variability have predicted the development of coronary artery disease and cardiac events. One study found that CMHS is associated with lower levels of high-frequency heart rate variability in the laboratory. In a study using ambulatory monitoring techniques, there was an inverse relationship between hostility and heart rate variability, but only during the day in men younger than 40.

### Anger and Physiological Reactivity

The emotion of anger is associated with a number of physiological changes that may have implications for the development of CHD. Anger is associated with increases in blood pressure and heart rate during laboratory procedures and daily life. Levels of the stress hormones norepinephrine, epinephrine, and cortisol become elevated in response to laboratory procedures that engender feelings of anger. In some cases, these changes can be very dramatic, such as when people are experiencing intense feelings of anger or when they lose their temper. For example, a series of studies have found that having people talk about anger-arousing

events in a loud and fast voice (i.e., an angry voice) resulted in increases of blood pressure and heart rate as high as 44 mm Hg for systolic blood pressure, 56 mm Hg for diastolic blood pressure, and 53 beats per minute for heart rate. These studies involved the discussion of past experiences, which likely underestimate the levels of blood pressure and heart rate that occurred at the time of the event. Such extreme physiological reactions may potentially be damaging to one's cardiovascular health. More frequently occurring lower-intensity feelings of anger with its associated physiological changes may also have a negative impact on health.

### Anger-Out, Anger-In, and Physiological Reactivity

*Blood pressure and heart rate (laboratory studies).* The way in which anger is managed or expressed is thought to play a role in the development of coronary artery disease and CHD. A major distinction in that respect is between the outward expression of anger (*anger-out*) and the experience of anger (*anger-in*). Anger-out and anger-in were originally conceptualized as existing on a continuum in which behavior ranged from the strong inhibition of angry feelings to the strong outward expression of angry feelings. However, a more contemporary view describes them as independent modes of anger expression. Trait anger-out has been defined as reflecting individual differences in the frequency in which angry feelings are expressed in verbally or physically aggressive behavior. In contrast, trait anger-in refers to the frequency with which angry feelings are experienced, but held in or suppressed. One early study examined dimensions of anger expression as predictors of physiological reactivity during a challenging anagram task. It was found that the outward expression of anger was associated with heightened levels of systolic blood pressure and forearm blood flow, but only during a task in which subjects were provoked and angered. Anger-in was not associated with changes in blood pressure in either condition, but was associated with greater forearm blood flow in the harassment condition. Other investigations, using anger induction paradigms, have consistently reported similar findings for measures of anger-out. In contrast, there has been little evidence suggesting that anger-in is associated with physiological reactivity.

Although subjects may become very angry in response to these paradigms, they typically do not

express their anger. Furthermore, it has been hypothesized that the relation between these two modes of anger expression and reactivity may depend on whether subjects are given the opportunity to express their anger. At least three studies have evaluated the relation between measures of trait anger expression and reactivity using anger induction techniques, such as anger recall and role-playing of interpersonal conflicts, which encourage the free expression of anger. In all three studies, measures of the outward expression of anger were associated with higher levels of diastolic blood pressure reactivity. In contrast, there was no evidence suggesting that individuals scoring high on measures of anger-in responded with elevated levels of physiological reactivity. Thus, across a variety of laboratory paradigms that engender feelings of anger, it appears that it is primarily anger-out and not anger-in that is associated with elevated levels of physiological reactivity.

*Blood pressure and heart rate (ambulatory studies).* Relatively few studies have investigated the relation between anger expression and ambulatory measures of blood pressure and heart rate. In one study, it was found that neither anger-out nor anger-in were related to ambulatory blood pressure in young male and female college students. Another study found that anger-out was not associated with ambulatory blood pressure or heart rate in a group of college students. The results for anger-in are mixed. One study reported that anger-in was not associated with blood pressure or heart rate in male and female college students, and the other reported that high levels of anger-in were related to higher levels of systolic blood pressure in a sample of hypertensive women. Thus, ambulatory studies do not yield the type of evidence observed in laboratory settings.

*Stress hormones.* The relationship between anger expression and stress hormones has also received some attention. Ratings by family members of subjects' propensity for aggression were associated with morning plasma concentrations of norepinephrine. Three studies have evaluated the relation between the outward expression of anger and physiological reactivity to an interpersonally stressful task.

In the first study, individuals scoring high on a measure of the outward expression of anger exhibited elevated levels of norepinephrine, cortisol, systolic blood pressure, and heart rate, relative to individuals

who scored low on the measure. In the second study, a behavioral measure of aggressive responding, which correlates highly with other measures of anger-out, was positively associated with elevated levels of norepinephrine, epinephrine, and cortisol in response to stress. Another study found a positive relation between anger-out and norepinephrine in response to a task in which subjects were provoked and angered. Furthermore, a measure of anger-in was not related to changes in norepinephrine. Finally, one study found that the relation between anger-out and early-morning levels of cortisol depended on level of work stress. Specifically, anger-out was associated with higher elevations of cortisol in individuals who reported high levels of work stress. This relation was not apparent at other times in the day. Thus, the evidence from these studies appears to parallel the findings from studies examining anger-out as a predictor of changes in blood pressure in response to interpersonal stress. At the present time, too few studies have examined the relation between anger-in and stress hormones to draw any firm conclusions.

## HOSTILITY AND PHYSIOLOGY: ACUTE EFFECTS

Another way in which anger may play a role in cardiovascular health is by triggering coronary events in vulnerable individuals. Indeed, anecdotal reports have long linked strong feelings of anger with coronary events. More recently, evidence from two studies suggests that intense outbursts of anger are potent triggers of heart attacks. Anger-induced myocardial ischemia and ventricular arrhythmias via alterations in autonomic tone are potential physiological mechanisms accounting for these findings. The effect of anger on the physiology of patients with heart disease has been the focus of some research because these individuals are prone to such events. Therefore, these studies provide a unique opportunity to better understand how anger plays a role in triggering coronary events. The evidence of studies of these kinds indicates that anger is capable of inducing myocardial ischemia and ventricular arrhythmias during daily activities as well as during laboratory tasks designed to engender such feelings.

Hostile traits that are associated with heightened physiological reactivity in response to anger-induced stress may play a role in triggering coronary events. As described in previous sections, traits such as cynical mistrust and anger-out are associated with a wide range of stress-induced physiological changes that may trigger heart attacks in vulnerable individuals. Thus, hostility may play an important role in cardiovascular health across all phases of the disease process.

## CONCLUSIONS

There is ample evidence that the cognitive, affective, and behavioral components of this psychological complex are associated with a variety of physiological responses. These are plausible mechanisms accounting for the association between hostility and CHD.

—Stephen H. Boyle,  
John C. Barefoot, and Redford B. Williams

See also ANGER AND HEART DISEASE; ANGER AND  
HYPERTENSION; ANGER: MEASUREMENT; CARDIOVASCULAR  
PSYCHOPHYSIOLOGY: MEASURES; CARDIOVASCULAR  
REACTIVITY; HEART DISEASE: ANGER, DEPRESSION, AND  
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MEASUREMENT

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## IMMIGRANT POPULATIONS AND HEALTH

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According to the 2000 census, approximately 1 out of every 10 people in the United States (11% of the total population) is an immigrant. Therefore, it is important to understand the unique profiles of immigrants, as well as the contextual factors that affect immigrant health. This entry presents a brief outline of the current demographics of immigrant populations and discusses a number of issues relevant to immigrant health. In order to develop a framework from which to consider the health of immigrants in the United States, emphasis is placed on acculturation, tuberculosis, access to health care, policy, and psychosocial factors.

### DEMOGRAPHICS

Patterns of immigration have shifted considerably during the course of American history. Throughout most of the 1800s, Europeans accounted for the majority of the immigrant population. Reasons for immigrating ranged from poor economic conditions to fear of religious or political persecution. According to the 2000 census, European immigrants comprise only 15% of the total foreign-born population; the majority is composed of Latino and Asian immigrants. Fifty-one percent of the total foreign-born population is composed of Latino immigrants. Mexicans (54%) comprise the highest proportion of Latino immigrants, followed by Cubans (7%), El Salvadorans (5%), and Dominicans (5%). Immigrants

from Asian countries represent 26% of the foreign-born population. China (19%), the Philippines (17%), India (14%), Vietnam (12%), and Korea (10%) are the largest contributors to the Asian foreign-born population.

The first significant waves of immigration from Latin American and Asian countries began in the late 1800s. Immigration policies during specific historical points, including some that targeted inclusion or exclusion of specific groups, influenced the rates and patterns of immigration. For instance, in the late 1800s, Chinese immigration was promoted by the recruitment of laborers to work on the Central Pacific Railroad Company's transcontinental railroad. A period of economic decline following the completion of the project led to the Chinese Exclusionary Act of 1882, which prohibited admission of Chinese laborers into the United States. Two years later, the law was revised to exclude all Chinese, and was in force until 1943. The Quota Law (1921) and National Origins Act (1924) established a quota system that discriminated against Eastern and Southern European and Japanese immigrants, respectively. During the Great Depression, a repatriation campaign forced large numbers of Mexicans to leave the country. But later, a labor shortage led to the bracero agreement, which encouraged Mexican farm workers to enter the United States.

The amendments to the Immigration and Nationality Act in 1965 removed many of the barriers for immigrants from Latin America, Asia, and Africa. After that time, however, the economic, cultural, and political climate in the United States has continued to influence migration patterns.

## DEFINING IMMIGRANT

The definition of immigrant varies across social science and legal domains. Social science definitions encompass life transitions, displacement from social settings, and adjustment to cultural values and norms—sometimes without regard to legal status. In contrast, legal definitions often capture the temporality and policy aspects of immigration but do not address psychosocial adjustment issues. For instance, U.S. immigration law categorizes individuals as either citizens or aliens. Citizen designation includes individuals born in the United States or those who derive citizenship from parents, or are naturalized. Aliens are further classified as (a) immigrants, who are lawfully admitted into the United States for permanent or conditional residence, and (b) nonimmigrants, individuals who enter the country for a temporary period. Therefore, some individuals classified as “immigrants” according to social science definitions would be considered citizens under immigration law (e.g., individuals who were naturalized). Defining immigrant according to Public Benefit Law determines eligibility for federal programs by classifying immigrant status into a “qualified” category, including legal immigrants, refugees, asylees, legalized aliens, and parolees. However, individuals considered immigrants for federal programs are not necessarily considered immigrants under immigration law. Because social and legal definitions do not overlap, precise classification of immigrants is critical for designing research on health, policy, and health care utilization of immigrant populations.

## HEALTH AND ACCULTURATION

Foreign-born individuals have better health on global indicators (e.g., self-reported health, activity limitation, and bed days) than their U.S.-born counterparts. This becomes particularly salient in the case of the epidemiological paradox of mortality among Latinos. Latinos are disproportionately represented among the poor, but the all-cause mortality rate is lower among Latinos than non-Latino Whites. Several explanations for the paradox have been proposed, including the *healthy migrant hypothesis* that selection of Latino migrants in good health results in lower mortality. Another migratory explanation, the *salmon bias hypothesis*, proposes that the desire to die in one's birthplace leads many Latinos to engage in

return migration, resulting in an artificially low Latino mortality rate because out-of-country deaths are not tabulated in U.S. mortality statistics. In contrast to migratory artifact explanations, the *health behaviors hypothesis* proposes that the lower mortality is genuine and is due to favorable health behaviors and risk factor profiles among Latinos, which contribute to their lower mortality. Tests of these hypotheses present numerous methodological issues and challenges. Nevertheless, the salmon and healthy migrant hypotheses have not been supported in recent research. Whether favorable health behaviors account for the epidemiological paradox remains a question for future research.

In light of the relatively good health of immigrants and the epidemiological paradox, it is interesting to note that positive health behaviors worsen with acculturation. Acculturation refers to the process by which immigrants adopt the attitudes, values, customs, beliefs, and behavior of a new culture. Alcohol consumption, smoking, and a number of other risky behaviors increase with acculturation. The mechanisms accounting for these findings are not clear, but may include loss of protective cultural health beliefs, behavioral practices, identity and values, and responses to continued discrimination.

Cancer rates, infant mortality, and other physical and mental health indicators, in addition to health behaviors, worsen with acculturation. For example, the incidence and mortality rates of various cancers (e.g., lung, colon, breast, ovary) among Latino immigrants are lower than those of their U.S.-born counterparts and U.S.-born non-Latino Whites. Furthermore, trends over time indicate that, for forms of cancer that are responsive to lifestyle and environmental factors (e.g., colon but not stomach cancer), the mortality rates of immigrant Latino groups increase toward those of the United States and are higher than rates found in their country of origin. Acculturation, therefore, presents some interesting challenges as it concerns the health of immigrants.

## TUBERCULOSIS

Tuberculosis (TB) has received a great deal of attention as an immigrant health issue. The migration of individuals from high prevalence to industrialized countries is a major factor sustaining TB prevalence. The proportion of immigrants among persons reported having TB exceeds 50% in some states

(California, New York, Texas, Florida, New Jersey, and Illinois). One of the most common hypotheses concerning the high rate of TB among the foreign-born is latent infection due to previous residence in a high prevalence country. Another frequently cited factor is the number of years elapsed since arrival in the low prevalence country. Some studies suggest that the rate of developing TB is higher in the first 2 to 5 years after arrival. Although some researchers attribute this increase to the stress of migration and resettlement, others cite lack of access to health care.

### ACCESS TO HEALTH CARE

Access to health care is a primary determinant of health status. Due to an increasing rise in the cost of health services, affordability (the ability to pay for care or health insurance) is a fundamental barrier to health care access for many Americans. Studies reveal that noncitizen immigrants are more likely to lack health insurance coverage than the native born and immigrants who have become citizens. Employment characteristics, legal status, and length of residency in the United States impact the uninsurance rates of immigrants. Among full-time workers, immigrants are more likely than nonimmigrants to obtain low-wage jobs that do not provide employer-sponsored health insurance.

Although access to health care is often conceptualized simply as affordability, it is important to consider other dimensions. For example, two other components of access—availability and accessibility—influence utilization of health and social services. Availability is defined by the location, concentration, and capacity of health care services in a given community. Accessibility describes the ease of obtaining services in the community, such as distance, transportation, and travel. Studies indicate that more physicians tend to practice in middle- and high-income rather than low-income neighborhoods in which immigrants are more likely to live, which results in a lack of choice and services available for obtaining medical care.

Accommodation, another component of access to health care, describes the tailoring of health services to fit the needs of a community. A large proportion of immigrants are classified as Limited English Proficient (LEP), which refers to the inability to speak, read, write, or understand English at a level that permits effective interaction. Therefore, bilingual or multilingual staff, translated materials, and

interpreter services are critical elements facilitating access to care for immigrants. A deficiency in such services can lead to miscommunication, misdiagnosis, patient dissatisfaction, and errors in and less adherence to medical treatment. Federal law mandates linguistically appropriate health care. Title VI of the Civil Rights Act of 1964 states, “No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal assistance.” Health institutions receiving federal funds are required to post policies regarding language access. Failure to accommodate programs to meet the needs of linguistically diverse populations creates access barriers.

Another component of access to health care, acceptability, refers to the actual and perceived value of care by the patient. Because culture influences how individuals define illness, suffering, and dying, the lack of cross-cultural skills among health care providers or their failure to understand cultural values may lead to poor patient outcomes and inappropriate interactions in clinical settings. For instance, Latino cultural values include the expectation that individuals be treated with *respeto* (respect) and *cortesía* (courtesy). These values take particular significance in the health care setting. Cultural incompatibility with mainstream health providers has been identified as a major obstacle against seeking health care, particularly in regard to mental health services. The importance of understanding cultural beliefs and values has led to a growing movement in cultural competence education in the health professions.

### POLICY ISSUES

Anti-immigrant sentiment and policy also affect health care access and utilization. Prior to the passage of any federal or state policy regarding public welfare programs, legal immigrants, like U.S. citizens, were entitled to and eligible for federal programs. But the passage of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) rendered immigrants ineligible for immediate access to federal programs. A new system of classification was developed creating a “qualified immigrant category,” which included, among other groups, lawful permanent residents. Some qualified immigrants must wait 5 years from the legal date of entry into the

United States to obtain federal benefits. Those immigrants who are not qualified are ineligible for benefits regardless of entry date. However, they are granted access to emergency services, emergency Medicaid, immunizations, and screenings for communicable diseases (e.g., HIV/AIDS and tuberculosis). States have the authority to create Medicaid and Child Health Insurance Plan (CHIP) programs, which provide benefits during the 5-year period to particular postenactment immigrants, providing another alternative to health care.

In addition, the Illegal Immigration Reform and Immigrant Responsibility Act of 1996 and California's Proposition 187 (passed in 1993 but not enacted) discourage immigrants and their children from accessing health care because of fears of becoming a "public charge" (i.e., dependent upon public benefits). Whether an immigrant is likely to become a public charge is one of the criteria used to determine entrance or immigrant status in the United States. Despite the Department of Justice's statement that Medicaid and CHIP recipients are independent of the public charge status, some immigrants have responded to these policies by not seeking health care from government resources, further exacerbating health problems. In addition, many families do not apply for public benefits to which they are entitled because of limited awareness of eligibility requirements, particularly for children. Because more immigrants delay care, there is an overreliance upon safety net facilities.

## PSYCHOSOCIAL ISSUES

In addition to anti-immigrant programs and policies, and barriers to health care that foster significant hardships, immigrants encounter a multitude of other stressors. Migration leads to profound changes in social networks, socioeconomic status and culture, and exposure to ethnic and racial discrimination. Among various immigrant groups, the cultural orientation to family offers an important social resource for dealing with these multiple stressors. The family provides strong social networks and multigenerational reciprocal support systems that promote physical and psychological well-being.

Upon settlement in the United States, contextual factors, such as neighborhood characteristics, serve as both resources and barriers to health. Settlement in ethnic enclaves (e.g., Little Havana in Miami, Chinatown

in New York City) creates mutual, supportive environments with a shared culture. Simultaneously, poverty, underemployment and unemployment, congested and substandard housing, and high rates of communicable diseases (e.g., TB), infant mortality, and crime characterize many of these communities.

The issue of ethnic enclaves bears directly on immigrant health. But there is a paucity of research in behavioral medicine on the role of broad contextual factors, such as ethnic enclaves, in promoting health. Much research in behavioral medicine is based on individual-level theories that ignore social factors. Furthermore, a deficit model often underlies research on the health of immigrants, in that assumptions are made about social forces *acting upon* individuals and groups, with little consideration of the cultural strengths and other social resources that enable individuals to act upon their environments and social circumstances. Research on social capital provides a framework from which to identify the social structures in ethnic enclaves that may enhance health. Social capital is defined broadly as the aspects of social structures that provide resources to individuals. Measures of social capital include membership and engagement in civic associations, levels of interpersonal trust, and perceptions of reciprocity. There is a growing body of evidence that social capital is an important resource for promoting health. Social capital may operate via several mechanisms, including the mobilization of social support, promotion of healthy behaviors, and other psychosocial processes. Interestingly, the communal (versus individual) cultural orientation that is characteristic of various immigrant groups suggests a major role for social capital in promoting health in ethnic enclaves. For example, the communal orientation of immigrant groups has led to the development of mutual aid organizations that provide legal, social, and other services to community residents and recent immigrants.

In conclusion, the goal of Health Care for All, promulgated by many government agencies, must extend to and encompass all individuals in the United States. The variety of cultural, structural, psychosocial, and policy barriers to health that are unique to immigrant groups must continue to be studied and addressed. It is important, therefore, to avoid attributing adverse health outcomes to cultural variables in lieu of a thorough exploration of the broader social and policy factors that may be involved. Furthermore, these broad contextual factors should also be considered when



developing programs of research and service aimed at improving the health of immigrants.

—Ana F. Abraído-Lanza, Kellee White, and Elizabeth Vásquez

See also ACCULTURATION AND HEALTH; CULTURAL FACTORS AND HEALTH; HEALTH DISPARITIES; SOCIAL CAPITAL AND HEALTH; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH

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## IMMUNE RESPONSES TO STRESS

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Stress is "a physical, chemical, or emotional factor that causes bodily or mental tension and may be a factor in disease causation" (*Merriam-Webster's* 1998).

Stress has been described as harmful to one's health. The field of psychoneuroimmunology focuses on the influence of behavior on the interactions between the central nervous system, the endocrine system, and the immune system, and the impact on health. Effects on the immune system by one's behavior are mediated by a complex network of signals functioning in the bidirectional communication between the nervous, endocrine, and immune systems.

It was initially observed that the experience of stress has suppressive effects on the immune system. Recent data, however, have suggested that the magnitude and direction of this effect may be dependent on the characteristics and timing of the stressor. In general, acute stressors (lasting from minutes to hours) tend to stimulate the activity of the immune system, while chronic stressors (lasting from days to months or years) suppress the immune response. The fact that acute stressors up-regulate certain components of the immune response does not necessarily mean that the outcome is beneficial. For example, an acute stressor may produce or exacerbate skin allergies. Aside from the duration of the stressor, the nature of the stressor itself tends to have differing effects on various aspects of the immune system.

Two mechanisms by which the immune system can be affected by stress include the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal medullary (SAM) axis. The term *axis* in this context is used to describe the physiological interactions that take place between the hypothalamus, pituitary gland, and adrenal gland. These mechanisms operate by producing biological mediators, including cytokines (a class of small proteins produced by immune and other types of cells that control the immune response) and neuroendocrine hormones, which interact with and affect cellular components of the immune system. For example, stress-induced activation of the HPA axis influences the immune system by the release of neuroendocrine hormones from the pituitary gland. Mediated by receptors for neuroendocrine hormones and neuropeptides, white blood cells in the lymph nodes and bone marrow (lymphoid and myeloid cells respectively) are able to respond to signals from the HPA axis and modify their functions.

In addition, the sympathetic nervous system plays a role in stress-induced changes in immune response through the SAM axis. For example, lymphoid and myeloid cells also have receptors for the catecholamines epinephrine and norepinephrine, which

enable them to respond to signals from the SAM axis. Immune cells can be stimulated to release cytokines, which in turn stimulate the increased production of corticotropin-releasing hormone (CRH) by the hypothalamus. CRH promotes the release of adrenocorticotrophic hormone (ACTH) and corticosterone by the pituitary gland and the adrenal cortex respectively. It has also been demonstrated that various aspects of the immune response, such as proliferation of B- and T-lymphocytes, cytokine production, antibody responses to "nonself" molecules, migration of monocytes and neutrophils, and natural killer (NK) cell activity, can be affected by glucocorticoid hormones, such as cortisol, as well as peptides, such as ACTH, endorphins, substance P, and somatostatin.

In addition to cytokine production, it has been shown that white blood cells are themselves capable of synthesizing hormones, including ACTH, growth hormone, and prolactin. Furthermore, primary and secondary lymphoid organs, including bone marrow, thymus, spleen, and lymph nodes, are innervated by nerve fibers of the autonomic nervous system. The close association of these nerve terminals with immune cells allows direct neural-immune interaction through the formation of neuroeffector junctions. Norepinephrine, substance P, and other neurotransmitters are released at these junctions and can subsequently affect immune cells in the microenvironment of a lymph node, thereby affecting their function. The implications of these interactions are not yet understood.

White blood cells such as lymphocytes, monocytes/macrophages, and granulocytes have been shown to exhibit receptors for many neurotransmitters. It has been described that catecholamines can cause changes in immune function such as migration and multiplication of lymphocytes, B-lymphocyte antibody production, and cell destruction through the regulation of cyclic AMP (cAMP) levels. In addition, it has been shown that the treatment of leukocytes with catecholamines in tissue culture results in the suppression of interleukin (IL)-12 synthesis and an increase in IL-10 production. This can cause a shift in the T-helper (Th) lymphocyte population from Th1, which function in cell-mediated immune activities, to Th2 functions, which are involved in antibody responses.

Examples of stress-associated immune changes are provided in studies involving medical students taking examinations. The effect of examination stress on healthy medical students can cause a decrease in NK

cell activity, a decrease in the response of leukocytes to plant products that induce cell division (mitogens), a decrease in production of interferon-gamma (IFN- $\gamma$ ) by leukocytes, a decrease in the antibody and virus specific T-lymphocyte responses to a hepatitis B vaccination, and changes in the ability of the immune system to control the expression of dormant herpes viruses such as Epstein-Barr virus (EBV) and herpes simplex virus type 1 (HSV-1). These medical students also reported an increased incidence of upper respiratory tract infections.

A stress-induced Th1/Th2 shift has also been observed in animal models. A restraint stress model used in studies with mice suggests that stress drives a shift in the Th1/Th2 balance toward Th2 dominance. A significant decrease in NK cell activity and in IFN- $\gamma$  production by mitogen-stimulated cells isolated from spleens, and a concomitant increase in serum corticosterone levels, were observed after restraint stress. Another study showed that restraint stress inhibited migration of leukocytes and Th1 cytokine production during *Listeria monocytogenes* infection.

The chronic stress of caregiving for a spouse with dementia was associated with the down-regulation of cellular immune responses. For example, leukocytes from the caregivers exhibited an inhibition of T-lymphocyte responses to mitogens and a monoclonal antibody to the T-cell receptor, a poorer memory immune response to HSV-1, and an inhibition of the ability of NK cells to respond to genetically engineered IL-2 and IFN- $\gamma$ . Caregivers also had a higher incidence of respiratory infections.

One of the factors implicated in the dysregulation of the immune response is the cytokine IL-6. Elevated levels of serum IL-6 are associated with stress and depression in humans. These results are consistent with those seen in rats exhibiting increased levels of plasma IL-6 after exposure to various stressors. This observed elevation in plasma IL-6 paralleled the increase in plasma cortisol. Together, these results support the idea that IL-6, along with other proinflammatory cytokines, plays a role in mediating effects of stress on the immune system and a role in increasing the possibility of extending inflammatory responses that can have important health outcomes such as risk for cardiovascular disease.

These studies suggest that psychological stress can affect immune responses to a degree that is large enough to put individuals at risk for the development and severity of infectious disease. This is of medical

concern, since the aging process results in a dampening of some components of the immune system, making older individuals at risk for stress-associated decreases in cellular immunity.

—Eric V. Yang and Ronald Glaser

See also AIDS AND HIV: STRESS; ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS; BEREAVEMENT AND HEALTH; CAREGIVING AND STRESS; STRESS: BIOLOGICAL ASPECTS; WOUND HEALING AND STRESS; PSYCHONEUROIMMUNOLOGY

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## INCOME INEQUALITY AND HEALTH

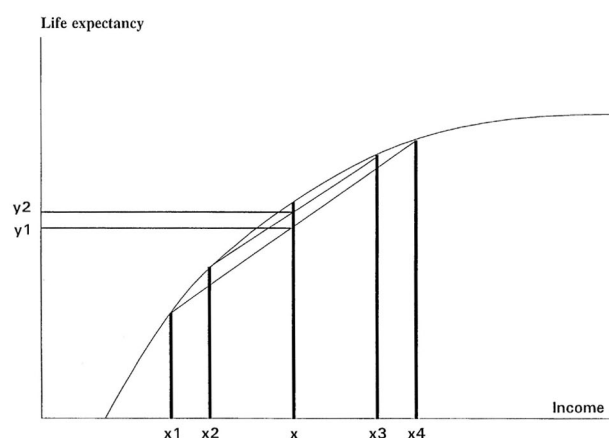
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### RELATIONSHIPS BETWEEN INCOME AND HEALTH

It is widely accepted that income is related to an individual's level of health. Higher incomes enable individuals to afford the goods and services necessary to promote health. It is equally recognized that poor health leads to loss of income, for example, because of extra expenditures on medical care, or because of loss of employment. This entry does not dwell further on the reverse causal pathway from poor health to lower income (for a detailed discussion of this pathway, see Subramanian, Belli, & Kawachi, 2002). Instead, we begin by discussing the various alternative hypotheses linking income to health outcomes. To summarize, four possible hypotheses have been put forward to explain the association between income and health.

#### Absolute Income Hypothesis

The absolute income hypothesis posits that individuals' health is determined solely by their own level



**Figure 1** The Concave Relationship Between Income and Life Expectancy

of income (and not anyone else's income). The relationship of individual income to health outcomes (such as risk of mortality) is sometimes described as a "gradient," that is, at each level of income, individuals experience better health than those immediately below them. Stated another way, worse health status is not confined to those individuals who live below some predefined poverty threshold (compared with those who are above it). Higher incomes appear to be associated with better health outcomes even within the middle-class range of incomes. On the other hand, to describe the association between income and health as a gradient is possibly misleading, since the relationship is not strictly linear, but rather concave (Figure 1), that is, there are diminishing returns to health improvement with additional rises in income (up to a point where the theoretical maximum life span is attained). We return later to the concave relationship between income and health.

### Relative Income Hypothesis

A second hypothesis linking income to health is the so-called relative income hypothesis, which posits that an individual's level of health is determined not just by the person's own level of income but also by the incomes of others in his or her community. In other words, the gap (or relative distance) between a person's income and the community average level of income may matter for health, in addition to a person's own (absolute) level of income. For example, a person earning \$10,000 per year might experience a different level of health, depending on whether others

in the community also earn \$10,000, or \$1 million. If the gap between a person's income and his or her community average income is large, this may result in invidious social comparisons and stress from efforts to catch up with the community standard of living. Sociologists have referred to this process as "relative deprivation." Relative deprivation may be harmful to health for reasons other than psychosocial processes. For example, rising community living standards are often associated with an enlargement of the range of consumer goods that are necessary to function as a member of that community. Many consumer goods, such as the telephone, the automobile, and access to the Internet, have followed the trajectory, starting out as luxury goods and eventually ending up as necessities. It follows that the income gap between the middle and bottom of the income distribution must be kept small in order to minimize the degree of social exclusion and relative deprivation.

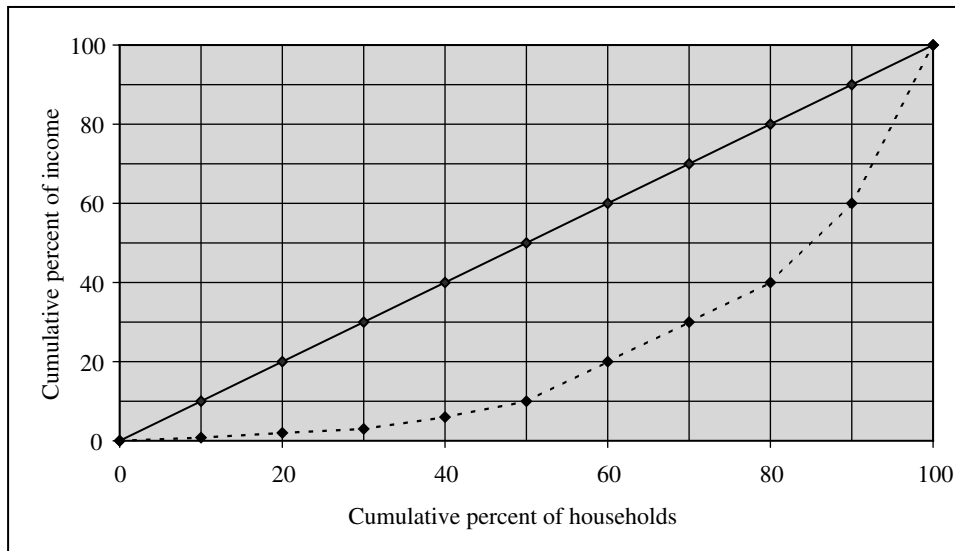
### Relative Rank Hypothesis

A third hypothesis concerning the relationship between income and health is the relative rank hypothesis. According to this hypothesis, it is not the goods and services that money can purchase that are relevant for improving health but rather the rank (or status) that extra income confers to the individual within the socioeconomic hierarchy. The theoretical basis for this hypothesis stems from repeated observations of the importance of rank in nonhuman primates (e.g., troops of baboons and macaque monkeys). In nonhuman primate societies, it has been observed that the lower the rank of the animal within a troop, the worse its health status. This finding is so robust that dominant animals that are experimentally assigned to a subordinate status develop depression, coronary disease, and other ailments.

### Income Inequality Hypothesis

The fourth and last hypothesis linking income to health is the income inequality hypothesis, which posits that an individual's level of health is determined not just by his or her own level of income but also by the extent of inequality in the distribution of income within his or her community.

In empirical terms, the absolute income hypothesis has been corroborated numerous times and appears quite robust. Much less empirical evidence exists to



**Figure 2** Lorenz Curve

support the relative income hypothesis, in part because of the difficulties of determining the relevant *reference group* against which individuals compare their incomes. Similarly, little work has been undertaken on the relative rank hypothesis, owing to the difficulty of isolating a pure rank effect from the simultaneous effects of income (i.e., rank and income are highly confounded). In contrast to the relative income and relative rank hypotheses, a growing number of studies have examined the effects of income inequality on population and individual health outcomes.

#### THE MEASUREMENT OF INCOME INEQUALITY

Various measures are available to quantify the extent of income inequality within a given community or society. Of these, the Gini coefficient is frequently used. Algebraically, the Gini coefficient is defined as half of the arithmetic average of the absolute differences between all pairs of incomes in a population, the total then being normalized on mean income. If incomes in a population are distributed completely equally, the Gini value is zero; and if one person has all the income (the condition of maximum inequality), the Gini is 1.0. The Gini coefficient can also be illustrated through the use of the *Lorenz curve* (Figure 2). On the horizontal axis, the population (in this case, households) is sorted and ranked according to income, from the lowest decile group to the top decile group. The vertical axis then plots the proportion of the

aggregate income within that community accruing to each group. Under conditions of perfect equality in the distribution of income (Gini = 0), each decile group would account for exactly 10% of the aggregate income, such that the Lorenz curve would follow the 45-degree line of equality. In reality, the Lorenz curve falls below the 45-degree line of equality, because the bottom groups in the income distribution earn considerably less than their equal

shares. (In Figure 2, it takes the bottom half of households to account for just 10% of the aggregate income.) The degree to which the Lorenz curve departs from the 45-degree line of equality is a measure of income inequality. As it turns out, the Gini coefficient is the ratio of the area between the Lorenz curve and the 45-degree line of equality, to the area of the triangle below the 45-degree line of equality.

#### INCOME INEQUALITY AND HEALTH THEORY

There is a straightforward relationship between the degree of income inequality in society and its average level of health achievement. The relationship is illustrated in Figure 1. As mentioned earlier, the relationship between individual income and life expectancy is concave, such that each additional dollar of income raises individual health by a decreasing amount. In a hypothetical community consisting of just two individuals—a rich one (with income  $x_4$ ) and a poor one (with income  $x_1$ )—transferring a given amount of money (amount  $x_4$  minus  $x_3$ ) from the rich to the poor will result in an improvement in the average life expectancy of that community (from  $y_1$  to  $y_2$ ), because the improvement in the health of the poor person will more than offset the loss in health of the rich person. Indeed, it is possible that by transferring incomes from the relatively flat part of the income/health curve, there would be no loss in health for the wealthy.

By extending this argument, one can see that, given two communities with the same average income level,

the community with the narrower distribution of income will have better average health status, all other things being equal. The basic reasoning behind this argument applies equally to the distribution of income within a society as well as between countries of the world.

Besides the above argument, income inequality may also have an additional effect on health by causing a downward *shift* in the income/health curve. In other words, at each level of income, individuals living in a less egalitarian community might experience worse health status. Testing this hypothesis requires hierarchical data, with information gathered on both individual incomes, as well as the extent of income inequality in the community within which he or she resides (see below).

### Mechanisms Linking Income Inequality and Health

Four mechanisms have been put forward to explain the link between income inequality and worse health status.

The first mechanism is through adverse patterns of social spending, accompanying the widening of income differentials consequently leading to reduced access to life opportunities. When the income distance widens between the rich and the poor, their interests begin to diverge, and groups find that they have less in common with each other. For instance, in more unequal societies, the pooling of resources that could finance public services such as health care systems and education is difficult to achieve. Because the rich tend to rely more on privately financed services, this translates into pressure to cut social spending, which in turn affects the access to social services for the poor.

A second set of processes is linked to diminished social cohesion that manifests through increased social tensions, erosion of social trust and mutual aid, and intergroup conflict. The wider the gap between the rich and poor, the greater is the strain on the social fabric and vice versa. For instance, during World War II in Britain, narrowing income differentials were accompanied by a greater sense of solidarity and social cohesion, besides an improvement in life expectancy. It is postulated that certain features of social relations—such as the level of trust between citizens, norms of reciprocity and mutual aid, and the ability to cooperate—represent resources for

achieving collective ends (see entry on Social Capital and Health).

A third potential pathway involves psychosocial pathways through which income inequality may result in invidious social comparisons, frustration, and stress, accompanied by negative emotions, hostility, and downstream physiological consequences. According to this view, income inequality results in direct physiological damage (through the repeated stress-triggered activation of the neuroendocrine and other systems), as well as more adverse patterns of coping behaviors, such as smoking or excessive drinking.

The above pathways are not mutually exclusive, though most empirical studies have focused on the first two mechanisms linking income inequality to health. Occasionally, the “access to life opportunities” and “psychosocial” interpretation of the income inequality-health link have been cast as if they were competing mechanisms. In reality, it is usually not possible to disentangle their unique effects from one another. In principle, all material resources of some relevance to daily life have some psychosocial meaning attached to them. For example, home or car ownership has both a material interpretation as well as a psychosocial one (as in the symbolic sense of security that home or car ownership affords). An Internet or telephone connection enables subscribers to find jobs or keep their jobs (calling in sick), as well as fulfill their sense of social connectedness. Even employment or money fosters a sense of control.

### Income Inequality and Health—Empirical Evidence

A growing body of literature has found that income inequality, over and above the effects of poverty and individual income, is detrimental to population health. Cross-sectional ecological studies have suggested that income inequality is associated with lower life expectancy, higher infant mortality, higher homicide rates, depressive symptoms, and lower self-rated health, in both developing countries and developed ones. An inverse relationship between economic inequality and lower health achievement has been reported *within* countries as diverse as the United States, the United Kingdom, Taiwan, and Brazil, as well as *between* different countries.

However, in order to address the potential confounding of income inequality by individual income,

studies must collect information on both income at the individual level and income distribution at the aggregate level, that is, they must be multilevel. Three trends emerge from the published multilevel analyses of income inequality and health. First, studies supporting a link between income inequality and health outcomes have been almost exclusively carried out within the United States, one of the most unequal societies in the ranks of the highly industrialized countries. In contrast, over half of the null studies have been carried out in societies that are more egalitarian than the United States, and moreover have welfare state protections that are more far-reaching than in the United States (e.g., Japan, Sweden, Denmark, New Zealand, and even the United Kingdom). Second, studies with positive findings generally tended to have larger sample sizes, especially comparing the positive and negative studies carried out on data within the United States. Third, studies with positive findings for income inequality have largely conceptualized income-inequality as a U.S. state-level covariate. By contrast, the majority of studies with null results have been carried out at units of aggregation that are smaller than the U.S. states (e.g., municipalities in Sweden, parishes within a single city, regions within New Zealand, constituency and regions in the United Kingdom, or U.S. counties and metropolitan areas).

Summarizing the existing data to date, there is a strong suggestion that studies need to be sufficiently powered to find an effect of income inequality on individual health outcomes. In other words, there must be a sufficient number of individuals within a sufficient number of areas to make the multilevel analysis meaningful. Furthermore, the studies suggest a more consistent effect of income inequality at larger units of aggregation (states) than at smaller units (such as census tracts, wards, or parishes). Although this pattern is largely driven by the U.S. state-level analyses, it provides a clue that the mechanisms underlying the observed association between income inequality and health likely involve political decisions at the state level regarding patterns of social spending that affect health. It must be noted that most studies on income inequality and health have paid less attention to other substantive issues such as the potential lag period between exposure to income inequality and health outcomes; the potential for a threshold effect of income inequality on population health; as well as the potential for cross-level interactions whereby state

income-inequality may affect the health of different population groups differently.

—S. V. Subramanian and  
Ichiro Kawachi

See also ECOSOCIAL THEORY; HEALTH DISPARITIES;  
NEIGHBORHOOD EFFECTS ON HEALTH AND BEHAVIOR;  
SOCIOECONOMIC STATUS AND HEALTH

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## INFERTILITY AND ASSISTED REPRODUCTION: PSYCHOSOCIAL ASPECTS

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### CAUSES OF INFERTILITY

A medical diagnosis of infertility is made when a pregnancy does not occur after one year of unprotected sexual intercourse. It is estimated that one in every six couples of childbearing age experience medically diagnosable infertility problems. For many years there was a belief in a diagnosis of psychogenic infertility, where infertility was seen to have psychological causes. However, extensive psychological research over many years has found no evidence to support this diagnosis. Furthermore, advancements in scientific analysis of the biological aspects of reproduction, namely eggs, sperm, and the male and female reproductive systems, have enabled the identification

of medical causes of infertility in cases that were previously determined to be “idiopathic infertility,” or infertility of unknown cause. In general, male factor problems relating to sperm numbers, morphology (shape), or motility account for 40% of infertility diagnoses; female factor problems such as ovulation disorders, fallopian tube blockages, endometriosis, or age-related egg problems account for another 40% of diagnoses; and combined male/female subfertility accounts for the remaining 20% of infertility cases.

Behavioral medicine research in infertility has focused primarily on the psychosocial consequences of infertility and its treatment, psychosocial factors associated with in vitro fertilization (IVF) outcome, and the development of psychosocial interventions to enhance coping with IVF treatment. We now briefly review types of infertility treatment available and the role of psychosocial factors in infertility and its treatment.

#### INFERTILITY TREATMENT: ASSISTED REPRODUCTION

Medical treatment for infertility has changed significantly following the development of IVF-assisted reproduction techniques. IVF is a process involving the fertilization of eggs from sperm outside the woman’s body. The resultant fertilized egg, or zygote, is incubated for several days and replaced several days later in the woman’s uterus. Although pregnancy rates worldwide have improved with IVF, implantation rates (i.e., the pregnancy rate per transferred embryo) currently range from 10% to 30%, depending on the IVF clinic and the age of the woman. However, there is significant variability in the reporting of treatment results as well as differences in the number of embryos transferred in any one cycle. Prior to the development of IVF, assisted reproductive treatment was limited to hormonal treatment for ovulatory problems, microsurgery for repair of tubal damage or vas deferens blockage, or insemination with sperm from either the male partner or an anonymous sperm donor. These treatments continue to be offered, but the assisted reproductive technologies of IVF, including recent variations such as intracytoplasmic sperm injection (ICSI), are utilized in more complex or difficult situations. While a medical diagnosis of infertility strictly relates to heterosexual couples practicing regular intercourse, infertility treatment may also be offered to the so-called social infertility of single

women, lesbian couples, and heterosexual couples who do not have regular sexual intercourse.

#### Psychosocial Impact of Infertility and Assisted Reproduction

##### *Negative Affect*

Despite there being no evidence to support the commonly held belief that infertility is caused by stress, there is considerable evidence that infertility and its treatment is the cause of significant stress and distress among infertile couples. Infertile women express higher levels of distress than fertile women, with the greatest distress peaking between the second and third year postinfertility diagnosis (Domar et al., 2000). Furthermore, research by Suzanne Miller and colleagues (1998) has found that infertile women report levels of infertility-related intrusive thoughts comparable with psychiatric outpatients being treated for stress reactions to traumatic events. Infertility-related distress appears to fluctuate throughout the infertility treatment cycle. A number of studies have found increased anxiety and depression in women both before treatment (but after diagnosis) and after unsuccessful treatment or neonatal loss. The grief reactions of the infertility experience have been likened to the loss of a loved one or of a longed for baby. Women frequently describe experiencing feelings of loss at each monthly menstrual period and particularly after an unsuccessful assisted reproductive cycle. Very little infertility research has included male partners; however, the limited research available consistently shows that at all points in the IVF cycle, women experience far greater infertility-related distress than do their male partners.

##### Coping Responses

For most couples, the diagnosis of infertility typically involves appraisals of threat and loss in relation to their expectations of parenthood. Less frequently, couples appraise an infertility diagnosis positively, perceiving this as an opportunity to enhance their personal relationship and to foster closer bonds. Coping responses to infertility vary according to the duration of infertility and within each member of the infertile couple. A perception of being out of control is a common response to infertility diagnosis. Problem-focused coping (e.g., seeking information) has been found to increase levels of well-being and reduce anxiety and depression, particularly in coping with



initial diagnosis and the commencement of IVF treatment. However, over time, if IVF treatment continues to be unsuccessful, emotion-focused coping or blunting strategies (e.g., emotional discharge and venting) become more adaptive in coping with the uncontrollable aspects of treatment. Moreover, the availability of social support has been found to facilitate adjustment to infertility over the long term. The coping strategies adopted by infertile women differ from those used by their partners. In general, women report utilizing a greater range of infertility-related coping strategies than men. This difference may be a reflection of the greater level of distress experienced by women. Furthermore, while women have been found to openly discuss their infertility among their wider support network of family and friends, men are more likely to discuss their infertility with only their spouse.

#### *Interpersonal Relationships*

Infertility additionally exerts considerable influence on the self-image and interpersonal relationships of infertile couples. In particular, spousal and other family relationships appear to be most affected by the experience of infertility. For a man, a diagnosis of sperm problems can affect his view of himself as a sexual and masculine being. In the case of an infertile woman, finding that she may not be able to conceive a child challenges her perceptions of herself as a mother, and for a family, an assumed next generation and an expected continuity may not occur. Infertility is an isolating experience, with loneliness particularly evident among women undergoing assisted reproduction. The impact of infertility can be seen as a long-term process, rather than a sequence of distinct events. Over time, the effects of infertility have been found to permeate through personal, work, and family relationships. Research by Boivin and colleagues suggests that the relationship between treatment failure and personal and marital distress appears to be curvilinear. Infertile couples with a moderate amount of treatment failure experience the most distress, whereas distress is lower for couples with low or high treatment failure rates, irrespective of age, years infertile, or years in treatment. These findings suggest that the experience of infertility-related distress is a necessary part of the process toward long-term adjustment.

Another aspect of the impact of infertility on interpersonal relationships is the effect of assisted reproduction on the experience of pregnancy and

parenting following successful treatment. Women conceiving through IVF report greater pregnancy-related anxiety, anticipate more difficult infants upon birth, and undergo less preparation for childbirth and parenthood than naturally conceiving women. However, as parents, mothers of children conceived using assisted reproduction experience less parenting stress and more positive mother-child and father-child relationships than mothers of naturally conceived children. Furthermore, in contrast to the greater parenting difficulties anticipated in IVF-conceived pregnancies, at 12 months postpartum, no differences have been found in child functioning in terms of attachment and parental responsiveness. Thus, while conception and pregnancy for couples utilizing assisted reproduction is characterized by increased anxiety and distress, the experience of parenting appears to be positive, with the children indistinguishable from their naturally conceived counterparts. The long-term effects of assisted reproduction conception on parental and child functioning are yet to be determined.

#### **Psychosocial Factors Associated With IVF Outcome**

There is some evidence that psychological factors, such as stress and anxiety, influence the outcome of assisted reproductive treatment. In general, women experiencing greater levels of infertility-related stress have poorer IVF treatment outcomes, in terms of number of eggs retrieved, number of eggs fertilized, and successful implantation/pregnancy. The results of a large, prospective multicenter trial in the Netherlands suggest that high levels of pretreatment anxiety and depression are associated with fewer pregnancies. Moreover, stress experienced prior to the commencement of IVF treatment appears to have the greatest negative impact on pregnancy outcome, compared with stress experienced throughout the IVF treatment cycle. A prolonged or chronic condition of stress also appears to be linked with lower IVF implantation rates. Moreover, recent research by Sherman, Montrone, and Miller (2002) suggests that other psychological factors may impact IVF pregnancy outcome. It was found that for women, the use of humor as a coping response, and for men, high levels of infertility-related distress, were associated with greater IVF pregnancy rates. Taken together, these findings suggest that psychosocial interventions may impact fertility status and the outcome of infertility

treatment. To date, very few studies have evaluated this hypothesis by developing psychophysiological interventions designed to minimize stress. There is some evidence that group-based psychological interventions designed to reduce stress among infertile women may lead to increased pregnancy rates. However, a lack of appropriate controls in these studies throws into question this apparent effect. Moreover, the underlying mechanisms by which such an effect could occur have still not been delineated, and remain open to investigation.

### Interventions

Worldwide there is acceptance of the importance of psychosocial support as a necessary component of assisted reproductive treatment for infertility. Psychosocial support entails patient education, implications counseling, decision-making counseling, and psychotherapeutic interventions. A variety of support approaches may be used depending on the stage of diagnosis and/or treatment, the degree of patient distress, and whether or not third party reproductive assistance is required. Counseling approaches entailing implications, decision making, and assessment are most often used when there is consideration of the use of third party-assisted reproduction. Consideration is given to the use of donated gametes (sperm or eggs) and embryos, or when it is proposed that a woman act as a surrogate to carry a pregnancy for an infertile couple. Complex social and psychological issues exist for all involved in third-party infertility treatment, as well as for any resultant offspring of this form of infertility treatment. In addition, counseling deals with issues related to privacy and disclosure of the identity of the biological parents of the child. Despite the general acceptance of the need for infertility counseling, few counseling approaches are theory guided, and there has been little effort to systematically evaluate the efficacy of counseling for couples undergoing IVF treatment.

The acknowledgment that infertility and its treatment is associated with psychological distress has led to the development of a small number of theoretically guided psychotherapeutic interventions targeted at infertile couples undergoing assisted reproduction. Patient education, cognitive-behavioral, and psychophysiological interventions are most often used in an infertility context. Pretreatment information sessions are frequently conducted in either couple or group

settings to assist patients to cope with understanding the technology and complexities of the treatment process. The rationale behind this approach is that by informing couples of what to expect when undergoing infertility treatment, they will be empowered, feel a greater sense of control, and be able to make informed decisions regarding treatment. The provision of pretreatment information has been found to assist infertile couples in mobilizing coping resources, in turn, assisting them in enhancing adjustment during treatment. However, patient education alone has limited usefulness, since its effectiveness varies as a function of the type of information provided (e.g., procedural, sensory, suggested coping strategies), the controllability of the stressor, and individual differences in response style (e.g., preference for information).

Cognitive-behavioral interventions involve techniques designed to instruct the infertile couple in effective coping strategies and problem solving, reappraising dysfunctional cognitions, and “preliving” through role-play and behavioral rehearsal. In a related vein, psychophysiological interventions are designed specifically to minimize the physiological (i.e., hormonal, neurochemical, and neuroanatomical) reaction to the stress of infertility and its treatment, by incorporating techniques such as relaxation training. Support strategies to assist with management of distress, anxiety, and depression include individual, couple, and group interventions. Strategies include stress management, relaxation techniques, cognitive reframing, and family therapy. Alice Domar utilized a multimodal cognitive group therapy approach (i.e., relaxation training, stress management, cognitive restructuring, gentle stretching exercise, and general health and nutrition education) to derive a reduction in anxiety and depression among infertile women. There is some evidence to suggest that both cognitive-behavioral and psychophysiological intervention approaches have their merits for reducing anxiety and depression among infertile women. However, a lack of adequate controls for these studies draws into question the validity of these findings.

Another factor that needs to be taken into account when designing intervention protocols is individual differences in response style. Specifically, according to Miller’s C-SHIP model, individuals are characterized by a distinctive profile of cognitive-affective response styles (high vs. low monitors). High monitors (who typically focus on and scan for health-related messages) are more likely to seek health-related information,

whereas low monitors (who distract from and ignore health-related messages) fare better when provided with minimal information. Therefore, high monitors should benefit most from psychosocial interventions designed to reduce excessive risk-related distress and to facilitate deeper processing, and fuller anticipation, of the personal consequences of infertility treatment. In contrast, low monitors should benefit most from psychosocial interventions that increase awareness of infertility and its treatment while at the same time providing a means of managing any infertility-related distress.

In summary, the experience of infertility is associated with psychological distress for both women and men. However, individual coping responses differ within infertile couples and as a function of the specific nature and duration of the infertility experience. A lack of theory-guided counseling interventions, and the dearth of appropriately controlled evaluation studies, precludes any definitive judgment of the efficacy of counseling interventions for infertile couples. To date, cognitive-behavioral approaches appear to hold the greatest promise, perhaps combined with the use of relaxation training. Despite the evidence that both the male partner and female partner responses may influence pregnancy outcome, psychosocial interventions have primarily targeted infertile women and have failed to address the unique needs of male partners. The differences in responses to infertility between men and women highlight the need for theory-guided psychosocial interventions tailored to the unique needs of each member of the infertile couple.

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Montrone, and Suzanne M. Miller

See also LOW BIRTH WEIGHT: PSYCHOSOCIAL ASPECTS;  
PREGNANCY OUTCOMES: PSYCHOSOCIAL ASPECTS; STRESS,  
APPRAISAL, AND COPING

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## INJURY PREVENTION IN CHILDREN

### THE PROBLEM OF INJURIES TO CHILDREN

#### Understanding Injury

The safety of children is one of the most pressing public health issues of our time. Injuries are responsible for more deaths in children over age 1 than any other health threat, and for every death from an injury, there are many more hospitalizations, emergency department visits, and outpatient treatment. Injuries occur when energy is transferred in ways, amounts, and rates that damage body structures and tissues. This can occur when a soccer player collides with a goal post, when an infant falls down the stairs, when a toddler swallows a household cleaner, or when two vehicles collide. While injuries are sometimes thought of as "accidents" or chance events of nature, it becomes clear that many injuries could have been prevented when the situations in which they happen are examined. For example, we know that teenage drivers demonstrate a higher rate of crashes and injuries than do adult drivers. However, the majority of these crashes and injuries occur in certain higher-risk situations, such as driving at night and with friends, and so could

be prevented by restricting the conditions of driving. To emphasize the preventable nature of injuries, most health professionals prefer to call these events “unintentional injuries” rather than “accidents.” Injuries may also be intentional, caused by acts of violence or abuse. Although important, the prevention of intentional injuries is quite different from the prevention of unintentional injuries, and so is not addressed in this entry.

Just as scientific advances such as immunizations and antibiotics led to improvements in the health of children, science also provides the public health community with tools for reducing the burden of childhood injuries. This entry addresses the problem of childhood injuries, what types of interventions have been developed to target this problem, and how individuals, organizations, and communities can help.

### Epidemiology of Childhood Injuries

The public health burden attributable to injury can be examined both in terms of morbidity and mortality. Data from the National Center for Health Statistics indicate that 8,913 children died due to an unintentional injury in the year 2000, and more children over the age of 1 die from an injury than from any disease. In addition, according to the National Center for Injury Prevention and Control, for every childhood death caused by injury, there are an estimated 34 hospitalizations, 1,000 emergency department visits, and many more visits to health care providers. Each year, between 20% and 25% of all children sustain an injury severe enough to require medical attention, missed school, or bed rest. These injuries not only result in costs to life and health, but in financial costs as well. For example, in 1996, childhood unintentional injuries resulted in \$14 billion in lifetime medical spending, \$1 billion in other resource costs, and \$66 billion in present and future work losses, imposing quality-of-life losses equivalent to 92,400 child deaths (Miller, Romano, & Spicer, 2000). While considerable progress has been made in decreasing injuries to children in the United States, it is estimated that almost one third of those injuries to children could be prevented using existing technology and strategies (Rivara & Grossman, 1996).

Prevalence of injury is not evenly distributed across demographic groups, further evidence of the nonrandom nature of unintentional injuries. The most common risk factors include male gender and low

socioeconomic status (Grossman, 2000). These differences are likely attributable to both behavioral and environmental factors. For example, males tend to engage in more high-risk behaviors using fewer protective measures than females. Parents of lower socioeconomic status likely have fewer resources to devote to injury prevention measures, and their children may experience greater environmental exposure to risk for injury.

The most prevalent causes of childhood unintentional injuries vary by age, as children grow out of some kinds of risks and into others. For example, injuries common in young children include falls and burns, while sports-related injuries are common among adolescents. However, other injuries are important across ages. From infancy to young adulthood, motor vehicle crashes are a leading cause of death; drowning and house fires are also prevalent causes.

### HISTORY OF INJURY PREVENTION EFFORTS

During the middle of the 20th century, infectious diseases and birth defects were among the most serious and widespread health problems, affecting many more people than injury events. As a result, injuries, thought then to be largely unavoidable, received little attention from the medical community. However, as progress was made in addressing the most widespread medical conditions, it became clear that injury events were responsible for a disproportionate number of deaths and suffering. Unintentional injuries are now the leading cause of death in the United States from ages 1 to 34.

Important work in addressing injuries began with a seminal work by DeHaven in 1942 (as cited in National Committee for Injury Prevention and Control, 1989). He was the first to study the biomechanics of injury and to recognize that individuals could be protected more effectively or “crash-packaged” when injury events occurred. Gordon followed this work and in 1949 (as cited in National Committee for Injury Prevention and Control, 1989) proposed that injuries could be studied like infectious diseases. He offered that injuries happen when the host (the person injured), the agent (the cause of the injury), and the environment in which the injury occurs interact to produce the injury event. Then Haddon defined the agent as the “energy” that caused the injury and the “vector” as the source that delivers the energy. The

result of this work was the development of the Haddon matrix (Haddon, 1972), a table that classifies injury prevention strategies according to how they address the injury problem. Based on this matrix, injury prevention strategies may target the agent, the host, or the environment; they can also target different points in time relative to the injury. Pre-event strategies are those that prevent injuries from happening in the first place, while strategies targeting the event itself are designed to prevent injuries from being as serious when they do happen. Post-event strategies address the consequences of injury. For example, sports injuries can be addressed in the pre-event phase by targeting the individual or host through appropriate preseason conditioning. The agent of sports injuries can also be addressed in the event phase through the design and use of protective equipment, and the environment can be addressed in the post-event phase by providing certified athletic trainers at sporting events. The work of Haddon and others led to a shift in the public health community away from individual responsibility and the "accident-proneness" of individuals to the redesign of environments and products (Haddon, 1970).

## INJURY PREVENTION STRATEGIES

### Classification of Approaches

Strategies for any target and time point within Haddon's matrix may involve either active or passive approaches. Active approaches rely on changing the behavior of individuals to prevent injury, while passive approaches work automatically, without active participation on the part of the individual. Once implemented, passive approaches do not require repeated behavior change from the individual. An example of the difference between these strategies is illustrated in approaches to prevent injury from automobile collisions. Seat belts are an active approach. In order for individuals to be protected, they must buckle the seat belt every time they are in the car. Air bags, on the other hand, provide protection without the individual having to initiate any action, as do car design modifications such as manufacturing cars with a crumple zone and environmental changes such as modifying median spaces. Because passive approaches do not rely on obtaining repeated protective behavior from individuals, they are more effective and reliable in preventing injury than active approaches. As such, the public health community typically favors passive

approaches, except when they are not available or feasible. When passive approaches are not available or feasible, active strategies that require only one-time action on the part of the individual (such as turning down the temperature on one's hot water heater to prevent scalding of children) are the next most effective approach.

The majority of injury prevention strategies can be classified as educational, environmental, or legislative. Educational approaches are typically active; that is, they are designed to encourage individuals to adopt or continue prevention behaviors by increasing knowledge about a particular hazard or changing attitudes about the hazard. Environmental approaches, on the other hand, are typically passive, involving the modification of the environment in some way to prevent injury to individuals. Legislative approaches may be either active or passive, since either individual behavior or environmental modifications may be legislated. Educational, environmental, and legislative approaches are all important in reducing unintentional injury.

### *Educational Approaches*

Educational approaches to injury prevention are based on the premise that, given sufficient information, people will generally act to protect and promote their health. For example, we may assume that knowledge about the risks of baby walkers will discourage parents from using them. However, it is now well known that human behavior is much more complex than this. An individual's behavior is influenced by numerous factors, including attitudes, norms, environmental facilitators and barriers, and the characteristics of one's social groups or organizations. To be effective, then, educational approaches need to address relevant determinants of children's or parents' behavior. There are several theories of behavior that identify the most relevant determinants of behavior and are useful in guiding the development of behavioral interventions to prevent injury. Among these are the health belief model (Rosenstock, 1974), theory of reasoned action (Ajzen, 1988), social cognitive theory (Bandura, 1986), precede-proceed model (Green & Kreuter, 1999), and precaution adoption process model (Weinstein & Sandman, 2002).

Educational strategies have been used extensively in both clinical and community settings. In clinical settings, efforts often target parents when they obtain

health care services for their children. Because information received from health care providers typically has high credibility, this approach can be successful in persuading parents to adopt injury prevention practices. A review of injury prevention strategies in clinical settings (DiGuseppi & Roberts, 2000) found that these types of efforts could be effective in promoting the use of safety behaviors by parents but only when guided by theories of behavior and behavior-change strategies.

Community-based educational strategies target a group of individuals or a geographic area, such as a school, neighborhood, or city. As with educational strategies in the clinical setting, the effectiveness of community-based approaches varies depending on the quality and comprehensiveness of the program. Community-based educational approaches that are successful use an array of strategies to target a series of factors influencing health behaviors; are based on theories of behavior change; are integrated into the community and tailored according to community needs; and involve community stakeholders in the development of strategies (Klassen, MacKay, Moher, Walker, & Jones, 2000). An example of such a program is the Seattle Bike Helmet campaign, which included strategies for increasing parents' awareness of the effectiveness of bicycle helmets, changing peer norms to make helmets "cool," and subsidizing helmet costs. The program resulted in an increase in bicycle helmet use among children and adolescents from 2% to 60% in 10 years (DiGuseppi, Rivara, Koepsell, & Polissar, 1989).

#### *Environmental and Policy Approaches*

It is often possible to modify some aspect of the environment to decrease the risk for injury. When injury can be prevented through changing the environment rather than individual behavior, benefits are likely to be greater and more evenly distributed in the population. These types of approaches are especially useful for vulnerable populations such as children. For example, a review of community-based injury prevention interventions (Klassen et al., 2000) found limited support for the effectiveness of community-based education for improving pedestrian safety among young children. The author concluded that young children are not developmentally prepared to learn and react appropriately to traffic. As such, environmental modifications that limit the speed of

traffic and its proximity to children, such as speed limits, speed bumps, traffic signs, routing heavy traffic away from neighborhoods, and narrowing roads, are likely to demonstrate greater effectiveness.

Environmental approaches to injury prevention may include product modifications as well as changes in the physical environment. Changes in the environment include strategies such as the above-mentioned traffic safety measures, the installation of air bags in cars, the use of fences with self-latching gates around pools, and the use of breakaway bases in baseball. Product modifications that have become standard in the United States include the use of child-resistant caps for medications, flame-retardant sleepwear, pre-setting of home hot water heaters to prevent excessively high hot water temperatures, and the replacement of traditional infant walkers with devices that allow infants to play in an upright position but that do not roll. Environmental changes such as these may occur through community efforts or legislation. In either case, the principles of individual and community behavior change addressed earlier remain important, as such changes may require individual and community support. As such, it can be particularly effective to combine educational and environmental approaches. For example, the Safe Kids/Healthy Neighborhoods Coalition in the Harlem neighborhood of New York City focused on renovating playgrounds, providing safe, supervised activities, providing injury and violence prevention education, and providing safety equipment at a reasonable cost. This program was effective in reducing targeted injuries, decreasing them by 44% over target injuries (Davidson et al., 1994).

Perhaps the most powerful approach to injury prevention is the use of legislative authority. Legislation may address the behavior of individuals, such as requiring the use of seat belts, car seats, and motorcycle helmets; environmental or product modifications, such as mandating child-resistant caps on medications, fences around pools, or the installation of universal child restraint attachment systems; or legal processes, as in the enactment of graduated drivers licensing. The effectiveness of a legislative approach is illustrated in the history of efforts to promote car seat use. Despite educational efforts, car seats were not extensively used in the United States until required by law. Similar processes have been observed with bicycle helmet usage. In a study comparing bicycle helmet use in three adjoining Maryland

counties, children in the county implementing combined education and legislative strategies showed a substantial increase in helmet use, while little change was observed in two neighboring counties using educational efforts only or no intervention (Dannenberg, Gielen, Beilenson, Wilson, & Joffe, 1993). When undertaken, then, legislation typically has a substantial impact on reducing injuries. For example, enactment of laws regarding childproof packaging of medications resulted in a 45% reduction from projected levels in childhood deaths due to unintentional ingestion of drugs (Rodgers, 1996). Analysis of motor vehicle crash data in New Zealand and the United States suggests that graduated driver licensing reduces crash injuries among adolescents (Ferguson, Leaf, Williams, & Preusser, 1996; Langley, Wagenaar, & Begg, 1996).

The use of legislation to reduce injury, while effective, requires that consideration be given to the inherent restriction of personal freedom for the promotion of societal health and welfare. When injury prevention behaviors or product specifications are mandated by law, the freedom of the individual is reduced. This trade-off between personal choice and societal protection has prompted long-standing debate, which is not often given adequate acknowledgment by either those favoring or those opposing a given legislation. Public health professionals recognize that legislation inherently restricts personal freedom, but also that society as a whole bears at least some of the costs associated with harm to its members. As such, restriction of individual freedom may be warranted for greater societal benefit.

Prior to the passage of legislation for injury prevention, then, a number of questions must be answered. What is the societal burden of the injury? To what degree does the legislation restrict individual freedom? How effective in reducing injury do we anticipate the legislation to be? Is the legislation enforceable? What other means are available to achieve a comparable reduction in injury? If it is determined that legislation is an appropriate approach, a number of other considerations are important. In general, one must consider the level of public support for the legislation and whether educational approaches are also needed to increase acceptance of and compliance with the legislation. If use of a particular product is to be required, certain factors need to be present. For example, before legislation regarding child safety seats was enacted, public support for their importance needed to be widespread, regulations for

the manufacture of child safety seats according to a prescribed set of safety and performance standards needed to be in place, and the seats needed to be widely available and affordable. In addition to these considerations, any potential adverse effects of legislation must also be addressed. For example, in Australia, after the passage of a law mandating bicycle helmet use, there was a 36% decrease in bicycle riding among children (Centers for Disease Control and Prevention, 1993), which was believed to be attributable to the law. It is unlikely that proponents of the law expected it to result in a decrease in physical activity, a critically important health behavior. Perhaps this adverse effect could have been prevented through prelegislation education and efforts toward influencing social norms regarding helmet use.

### Decision Making Regarding Injury Prevention Strategies

An important issue, then, is determining the most appropriate strategy or set of strategies to use to address a given problem area. In general, legislative approaches are most appropriate for injuries with a high cost to society (i.e., morbidity, mortality, financial) and for which other approaches are insufficient, or for protection of vulnerable populations such as children. Similarly, environmental approaches should be used whenever possible for the protection of children and other high-risk groups, for whom educational interventions may not be realistic. Because of their greater effectiveness, environmental approaches should also be considered for any injury with high prevalence and/or high cost to society. Finally, educational approaches are important for areas that cannot be adequately or appropriately addressed through environmental or legislative approaches, or for those that don't yet have the popular support necessary to address through environmental or legislative approaches. Educational approaches are most effective when they are theoretically driven and directed toward changing concrete behaviors that prevent specific injuries and have few environmental or attitudinal barriers. Overall, the most effective approaches use multiple strategies, and combine education with environmental or legislative change.

A comprehensive overview of issues involved in decision making regarding injury prevention strategies is provided by Runyan (1998). She contends that determining which injury prevention strategies to use

**Table 1** Value Criteria for Evaluating Injury Prevention Strategies

<b>Effectiveness</b> How well a given strategy actually reduces the problem should be a primary consideration. Unfortunately, this criterion may be ignored by well-meaning persons who observe a health threat and simply attempt to do “something” to address it.
<b>Cost</b> The cost of implementing the strategy should be determined and then considered with the first criteria to provide an estimate of cost-effectiveness. It is useful to consider the cost of the strategy as compared to the costs of not implementing it.
<b>Freedom</b> Strategies, especially legislation, may involve restricting the freedom of some persons. Consideration must be given to the benefits to society obtained by the strategy compared to the restriction in freedom imposed.
<b>Equity</b> Equity may be either horizontal or vertical. Horizontal equity involves treating all people equally, as in regulations regarding car seat use or medication packaging. Vertical equity, on the other hand, involves unequal treatment that results in greater equity. An example of a strategy promoting vertical equity would be providing smoke detectors to low-income persons.
<b>Stigmatization</b> A program or policy should not stigmatize persons or groups in the process of preventing injury. A strategy to which a population is opposed is unlikely to be effective. As such, one must take into account the sociocultural context in which a strategy is implemented.
<b>Feasibility</b> The strategy under consideration must be feasible to implement. The resources required must be available, and the strategy must be both technologically and politically feasible.

for a given problem requires the delineation and weighting of relevant value criteria, and conceptualizes this as the “3rd dimension” of the Haddon matrix. Relevant value criteria must be determined for any particular issue, but typically include the following: effectiveness, cost, freedom, equity, stigmatization, preferences of the affected community or individuals, and feasibility (see Table 1).

MAKING IT HAPPEN

Preventing injuries to children requires efforts throughout the community and within the larger social context. Parents and other adults act as the most direct protectors of children, implementing injury protection measures in the home and acting as child advocates to keep their environments free from hazards. School personnel play a key role in promoting safety in the school environment and often in providing basic safety education to children. Health care providers also have an important role in counseling parents on injury prevention as part of regular preventive health care, providing specific advice

relevant to the age and developmental stage of the child. Moreover, given their credibility and presence in the community, they are an important voice for the promotion of environmental changes and legislation that address injury prevention. Support for injury prevention measures is also needed from community leaders and coalitions, who may advocate for environmental change and legislative measures in their community.

Such efforts from individuals and groups are critical, but to be fully effective, they require an infrastructure to work in. Promoting and sustaining injury prevention activities requires organizational and structural support. This includes the collection and maintenance of reliable data on injuries, the training of clinical and research professionals in injury prevention, the availability of funding for injury research and practice, and the coordination of injury prevention efforts across local, state, federal, and nonprofit sectors. Much progress has been made in preventing injuries among children, but much more can be done. Coordinated efforts at the individual and community level, combined with organizational and structural support, are needed to reduce the public



health burden of injury to children. By building on our history of addressing pressing public health issues and by drawing upon existing public health tools, we can ensure that children have safer environments and minimized risk of injury.

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See also ADOPTION OF HEALTH BEHAVIOR; HEALTH BELIEF MODEL; HEALTH PROMOTION AND DISEASE PREVENTION; THEORY OF PLANNED BEHAVIOR; THEORY OF REASONED ACTION

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## IRRITABLE BOWEL SYNDROME: PSYCHOLOGICAL TREATMENT

Irritable bowel syndrome (IBS) is a widespread functional disorder of the lower gastrointestinal (GI) tract. A sizable proportion of IBS patients have noticeable psychological distress as measured by standardized psychological tests and as shown by a high occurrence of comorbid psychiatric disorders. Despite these situations, initial treatment of IBS tends to be with drugs and/or dietary interventions such as adding bran fiber to the diet. Recent meta-analytic reviews have not supported the efficacy of any particular class of drugs for IBS nor the efficacy of adding bran to diet.

Over the last 20 years, a large number of controlled studies have appeared supporting the efficacy of various psychological treatments for IBS. A detailed summary of this research appears in a recent book, *Irritable Bowel Syndrome: Psychosocial Assessment and Treatment* (Blanchard, 2001). Moreover, detailed assessment and treatment protocols for two of the three primary treatment approaches, hypnotherapy and cognitive-behavioral therapy, are also available in that book.

At this point there is strong research support for three separate psychological approaches to the treatment of IBS: hypnotherapy, brief psychodynamic psychotherapy, and cognitive-behavioral therapy. The latter term is used to encompass a variety of cognitive and behavioral techniques that have been used separately as treatments as well as in various combinations. The remainder of this entry briefly describes these three approaches, summarizes a prototypic research report illustrating the approach, and summarizes the research support behind the approach.

### HYPNOTHERAPY

The initial description of hypnotherapy for IBS was by Whorwell, Prior, and Faragher (1984) in England. Thirty patients with refractory IBS (they had failed various drug and dietary treatments) were randomly assigned to either seven hypnotherapy sessions over 3 months or to seven sessions of psychological support plus a drug placebo.

The hypnotherapy began with an arm levitation induction. The hypnotherapy aimed at general relaxation, gaining control of intestinal motility, and some ego strengthening. An audiotape to guide daily autohypnosis

practice was given to the patients. Evaluation was by means of a daily GI symptom diary and an independent assessor. All treatments, both hypnosis and supportive psychotherapy, were by the same therapist.

Results showed significantly greater reductions in bowel habit disturbance, abdominal pain, and bloating for those receiving hypnotherapy in comparison to the control group. The hypnotherapy also led to a greater increase in ratings of general well-being. A very impressive part of the results was that all 15 patients receiving hypnotherapy were either symptom free or suffering from only mild symptoms at the end of the 3-month treatment.

In later reports from this group, at an 18-month follow-up, 2 of 15 hypnotherapy recipients had relapses and were successfully treated with a single booster session. Results from a total of 50 IBS patients were positive for 42 cases (84% success rate). Patients who were possibly suffering from psychiatric disorders or who had primarily intractable abdominal pain were less likely to respond. The treatment protocol was evidently lengthened from 7 sessions to 10 or 12 sessions over 3 months. In a second randomized, controlled trial by this research team, hypnotherapy was superior to a wait list condition on reduction of abdominal pain, bowel habit dysfunction, and bloating.

A very important independent replication of these results was also completed in England in 1989. Individually administered hypnotherapy and group-administered hypnotherapy did equally well, leading to 61% of 33 total patients being symptom free or improved at the 3-month point.

Last, a study from my laboratory, utilizing Whorwell's protocols, replicated Whorwell's hypnotherapy treatment in the United States with 11 patients. Those initially receiving treatment were significantly superior to a symptom monitoring, wait list control. The latter were crossed over to treatment. Overall, 55% of patients were improved, based on a reduction in a composite GI symptom score from the diary, and 18% were somewhat improved. There were also significant reductions in state and trait anxiety. Results held up well at a 2-month follow-up. Success in GI symptom relief was not related to hypnotic susceptibility.

### Conclusions

Hypnotherapy has been shown in four separate controlled trials to be of noticeable benefit in comparison

to control conditions. Most important, the positive results have been replicated in two independent centers with different therapists. Results have held up well for at least 18 months. From 55% to 100% of patients benefit from treatment.

### BRIEF PSYCHODYNAMIC PSYCHOTHERAPY

The strongest trial evaluating brief psychodynamic psychotherapy was conducted in England by Guthrie, Creed, Dawson, and Tomenson (1991) and involved 102 IBS patients who had failed to respond to standard medical care over the previous 6 months. Fifty-three patients were randomized to psychotherapy, while 49 were on a 3-month wait list. Thirty-three of the latter were crossed over and received the treatment. Evaluation was by patient symptom diary, independent medical assessor ratings, and a psychiatrist's structured ratings of anxiety and depression.

All treatments were conducted by a single therapist. Treatment consisted of a long (2- to 4-hour) initial interview in which bowel symptoms and psychological problems were explored in depth. There followed six additional interviews over 3 months during which there was an attempt to help the patient adopt a positive attitude and to change beliefs and attitudes in small steps. Patients were given a relaxation tape for regular home practice.

The psychotherapy patients showed greater improvement in anxiety and depression than the controls. Global ratings by both physicians and patients showed greater change on a composite of all GI symptoms than found for the controls. Sixty-seven percent of the 46 treatment completers were improved. At the 6- to 9-month follow-up using global patient ratings, 73% of the treated patients rated themselves as improved.

The other psychotherapy trial is from Sweden and is the earliest (1983) controlled evaluation of psychological treatment for IBS. Fifty chronic IBS patients received 10 sessions over 3 months of psychotherapy, while 51 additional IBS patients were randomized to routine medical care using the full array of medications. The psychotherapy was described as aimed at modifying maladaptive behaviors and finding new solutions to problems. However, therapy was described as dynamically oriented and supportive, with most work on a conscious level. The number of therapists is not specified. Five patients dropped out but were reevaluated.

Evaluations at the end of treatment and a 12-month follow-up were by independent evaluators using global ratings of several symptom clusters. The results showed significantly greater improvement for psychotherapy in comparison to routine medical care on abdominal pain and total somatic symptoms at post-treatment. At the 12-month follow-up, the treated group continued to show greater improvement on these two ratings plus greater improvement in bowel dysfunction. There was comparable improvement in both groups on ratings of mental symptoms. No data were available on the fraction of the sample that improved.

### Conclusions

Brief psychodynamic psychotherapy has been shown to be superior to routine medical care in two large-scale, controlled trials; the results appear to hold up well over follow-ups of 6 to 12 months. The therapies seem quite different in details and thus are not replications like those available in the hypnotherapy literature. However, conceptually, the two treatments are similar and certainly support the efficacy of this approach.

### COGNITIVE AND BEHAVIORAL THERAPIES

#### Combinations of CBT

Combinations of cognitive and behavioral techniques have been evaluated in nine studies conducted in England, Canada, the Netherlands, and the United States. Most have been relatively small trials with fewer than 20 patients in the active treatment condition. At least two of these controlled trials, however, had 30 or more patients per condition. Most ( $n = 7$ ) of the studies have used individually administered treatments; however, two of the controlled trials, and one quasi-controlled trial from our center, have used CBT in small groups. The controlled trials have all used some form of relaxation training and its application, usually abbreviated progressive muscle relaxation (PMR). Almost all provide some education about IBS, normal bowel functioning, and the possible relation of stress to bowel symptoms. Some have included assertiveness training. The cognitive therapy components usually are modeled after the work of Meichenbaum or Beck. In this they usually are trying to address and change potentially negative, or

self-defeating, self-dialogue (Meichenbaum) or identifying and correcting cognitive fallacies and negative schema (Beck). Emphasis is placed in both approaches on having participants keep a diary of their self-dialogue and thoughts surrounding stressful events and onset of pain and other bowel symptoms. In some trials from our center we have added thermal biofeedback for hand warming as an additional relaxation technique. Others have focused on operant approaches to pain management.

Evaluation has usually been by patient symptom diary, psychological tests, and patient global ratings. Control conditions have usually been waiting list, symptom monitoring controls, or routine medical care. Two studies also used sophisticated psychological attention-placebo controls in addition to symptom monitoring, while another used a psychoeducation group in addition to routine medical care.

Results have been mixed. In all studies there has been some differential improvement of CBT versus one of the control conditions. However, in some studies the difference was only on a psychological test (reduction of anxiety or depressive symptoms) or on global ratings. However, in several studies there was differential improvement on GI symptoms from a patient diary favoring active treatment. Follow-ups of up to 4 years have shown reasonably good maintenance of symptom reduction as validated by the GI symptom diary. Interestingly, in the large-scale studies comparing CBT to a psychological control and symptom monitoring or routine medical care, there were no significant advantages for CBT over the active psychological control.

A prototypical report by Blanchard et al. (1992) described two studies identical in treatment conditions and measurement. In the first, there was only one therapist and 10 patients per condition. In the second, there were 6 therapists and 30 patients per condition. In each instance, patients were seen for 12 individual sessions over 8 weeks with evaluation by patient symptom diary and psychological tests.

The CBT condition contained patient education, PMR, thermal biofeedback, and cognitive therapy modeled after the work of Meichenbaum. The active psychological control condition combined pseudo-meditation and biofeedback for alpha suppression. A symptom monitoring control was the third condition.

In both instances, the CBT showed arithmetically greater reductions in a composite GI symptom measure from the diary than the attention placebo

control or the symptom monitoring control. Fractions of the samples improved were 60% in the small study but only 47% in the larger study. Three-month follow-up data showed better maintenance for CBT than the attention placebo condition.

## Conclusion

When combinations of behavioral and cognitive procedures have been subjected to rigorous tests by comparing them to active psychological control conditions as well as symptom monitoring controls, even in moderate-sized trials with 30 or more patients per condition, the CBT treatment has not been superior to the active psychological control. Nevertheless, 50% or more of patients have been improved, and the average within group decrease in GI symptoms, and in measures of psychological distress, are significant. These combination treatments seem to work.

## INDIVIDUAL BEHAVIORAL AND COGNITIVE TREATMENTS

Our inability at my center to successfully replicate the positive results from the CBT combination treatments has led us to evaluate individual components of the treatment package. In two studies we have found a pure relaxation condition superior to a symptom monitoring control on a composite measure of GI symptoms from a daily diary. Thus, both PMR and a more passive form of relaxation, meditation based on Benson's relaxation response, were superior to symptom monitoring. We did find the PMR condition had a high dropout rate (about 40%).

### Pure Cognitive Therapy

There have been three controlled studies evaluating a purely cognitive therapy approach to IBS. In all three, individually administered cognitive therapy, 10 sessions over 8 to 10 weeks, has been superior to a symptom-monitoring control. In one it was superior to a psychoeducational support group (described in more detail below); in another it was equivalent to cognitive therapy administered in small groups. Each trial had a different single therapist (an advanced doctoral student in clinical psychology). Evaluation was by means of GI symptom diaries and psychological tests.

At my center we have obtained our most consistent results with this approach: 70% of patients improved

based on the composite GI symptom score derived from the daily diaries; the average GI symptom score was reduced by 60%. There was also significant improvement in standardized psychological tests measuring anxiety and depression. In probably the strongest study testing individual cognitive therapy, Payne and Blanchard (1995) randomly assigned 12 IBS patients to individual cognitive therapy, 12 to psychoeducational support groups, and 10 to a symptom monitoring, wait list control. The sample was 85% female, of average age 40.1 years, who had been suffering from IBS for 16.1 years. Eighty-five percent met criteria for one or more Axis I psychiatric disorders.

In the cognitive therapy, the patient was given a model of the relation of thoughts to stress and to IBS symptoms and asked to begin monitoring stressful situations and surrounding thoughts. After systematically working to correct self-talk, treatment began to focus on logical fallacies and cognitive schema as they related to IBS symptoms and stress.

In the psychoeducational condition, participants met in small groups of three to five and dealt with a number of topics such as diet and symptoms. The emphasis was on teaching participants to be able to talk about IBS issues with peers and derive support from the experience.

Results showed an average reduction in GI symptoms of 67% for cognitive therapy, 31% for the support group, and 10% for those in symptom monitoring. Three quarters of those in cognitive therapy were improved based on symptom diaries. There was differential benefit for those in cognitive therapy on most individual GI symptoms in comparison to each control group. Moreover, there was a differential reduction of symptoms of anxiety and depression. Most important, the level of expectation of benefit from pretreatment questionnaires was equivalent for the two treated groups. The symptomatic reduction results held up well at a 3-month follow-up.

To the best of my knowledge, this is the only CBT study for which a cognitive or behavioral treatment has been superior to a highly credible psychological placebo condition.

## Conclusions

Our results from my center with cognitive therapy are impressive and consistent. Across three separate replications, we have seen strong results, leading me

to conclude that it is the best treatment among the cognitive and behavioral therapies that have been applied to IBS.

## OVERALL SUMMARY

The strongest evidence to support the efficacy of a psychological treatment for IBS is for hypnotherapy. The independent replications in randomized trials give it the nod. The second strongest case exists for pure cognitive therapy. There are three controlled trials, including one for which it was superior to a credible, active psychological placebo. However, all three trials are from the same center but did use different therapists.

Combinations of cognitive and behavioral therapeutic techniques have good cross-site replication and good follow-up data, but the results are inconsistent. Brief psychodynamic psychotherapy has shown strong results in two separate trials with good follow-up; however, the therapy appears to be different at different sites, leaving us awaiting replication.

In any event, the literature seems to clearly show the viability of psychological treatments for IBS. The time may be ripe for large-scale direct comparisons of psychological and drug treatments for this widespread, chronic condition.

—Edward B. Blanchard

See also CHRONIC DISEASE MANAGEMENT; IRRITABLE BOWEL SYNDROME: PSYCHOSOCIAL ASPECTS

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## IRRITABLE BOWEL SYNDROME: PSYCHOSOCIAL ASPECTS

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder that consists of abdominal pain or discomfort combined with altered stool frequency or consistency. The behaviors, illness experiences, and clinical outcomes of people with IBS are closely related to psychosocial factors such as life stress, psychological state, abuse, social support, and coping strategies.

IBS is currently viewed within a biopsychosocial context, which incorporates both the physical and psychosocial factors accountable for the illness. Psychosocial factors can affect physical factors, such as gut physiology (i.e., stress can increase the rate of colonic contraction). Gut function can also negatively affect a person's psychosocial state (i.e., frequent exacerbations of abdominal pain can lead to further anxiety and depression and increased vigilance to symptoms). A potentially vicious cycle can then be created between the two, which can worsen IBS symptoms and psychological disturbances.

### LIFE STRESS

Patients with IBS appear to have an exaggerated gastrointestinal response to stress. While anxiety and stress can cause gastrointestinal urgency, cramps, or diarrhea in all people, the effect of stress on people with IBS is even greater. Stressful life events (such as a death in the family, a surgical procedure, employment or financial problems, or marital difficulties) are associated with the onset of symptoms in more than half of people with IBS. One study found that stress causes altered stool patterns and abdominal pain in a larger number of people with IBS than controls (73% and 84% of IBS patients respectively, as compared with 54% and 68% of controls). The result of these gastrointestinal changes can be increased bowel symptoms, physician visits, and disability days for people with IBS.

### Psychological State

Psychological states can affect people's illness perception, which can result in greater health care seeking behavior. Their symptom intensity, illness behavior (defined as how symptoms are evaluated, perceived, and acted upon), and perceptions of symptom status can also be affected. It is therefore not surprising that psychological disturbances are more common in people with IBS that seek medical attention than in people with IBS who do not solicit medical assistance (IBS nonpatients). In contrast, the prevalence of psychosocial disturbances and the personality profiles of IBS nonpatients are similar to those found in the general population. IBS patients seeking medical attention suffer from a high prevalence of psychiatric and psychological disturbances such as anxiety, depression, phobias, and somatization. Somatization is defined as the expression of psychological stress through physical symptoms, and it tends to occur more often during times of stress. IBS patients also tend to have higher levels of hypochondriasis and hysteria than both nonpatients and controls. Other personality factors common to IBS patients are the minimization of emotional concerns, excessive concerns about health or bodily functions, and the continual need for reassurance about their health.

A life-events score is an individual's measure of the desirability of life events and of their impact and effect on the person's life (a measure of "good or bad"). If the summation of the life events is positive, then the individual is given a positive life-events score. IBS patients tend to have lower positive life-event scores than IBS nonpatients, signifying that IBS patients may perceive life events more negatively than people without IBS.

### Coping Strategies

While coping strategies are generally helpful, some can be maladaptive and influence the clinical outcome of IBS. In a recent study, women with IBS who perceived an inability to decrease symptoms and exhibited catastrophizing behaviors—defined as pessimism and maladaptive coping related to pain (e.g., "I feel it's never going to get any better")—had a poorer clinical outcome during the 1-year follow-up. The negative effect of coping strategies on IBS is independent of the effects of abuse or psychological factors.

Therefore, the clinical outcome of IBS is strongly affected by coping skills or strategies.

The social learning of coping strategies and illness behaviors is also an influential factor in IBS. IBS symptoms are often found throughout families: the children of IBS patients exhibit similar patterns of illness behavior and seek medical attention for similar gastrointestinal symptoms as their parents. These behaviors were probably learned through childhood reinforcement and modeling of gastrointestinal symptoms.

### Abuse

Many IBS patients have a history of abuse (physical, sexual, and emotional), especially during childhood. In a tertiary referral center, it was found that, of women with functional gastrointestinal disorders, 53% reported sexual abuse and 13% physical abuse. The connection between abuse and IBS most likely stems from abused patients' catastrophizing coping strategies and difficulty judging harmful stimuli. In fact, a history of abuse is the strongest predictor of poor treatment outcome for IBS patients. As compared to nonabused IBS patients, IBS patients with a history of abuse tend to experience an increase in severity of IBS, psychological disturbances, frequency of physician visits, and surgery throughout

their lifetime. In addition, they have decreased daily function and a poorer clinical outcome than nonabused IBS patients.

—Anthony Lembo  
and Rebecca Fink

See also CHILD ABUSE, CHILD NEGLECT, AND HEALTH;  
COMORBID MENTAL AND OTHER PHYSICAL DISORDERS;  
IRRITABLE BOWEL SYNDROME: PSYCHOLOGICAL TREATMENT

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## JOB STRAIN AND HEALTH

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Job strain results when work is organized in a way that allows workers little job decision latitude and requires high levels of psychological job demands. The interaction of job decision latitude and psychological job demands to create job strain is figuratively depicted as a cross-tabulation.

### EXPLANATION

Job strain results from how work is organized. Work systems are often organized to maximize how much a worker does and to ensure that the quality of the work done is at a consistently high level. To maximize how much a worker does, companies will increase production requirements to the point where quality is not sacrificed. To ensure consistently high levels of quality, the job is often simplified by reducing task variety or the skills required to get the job done. The manufacturing assembly line represents one type of work system where production requirements are high, quality is consistent, and the tasks to be done are simple and repetitive. In today's computerized workplaces, information systems monitor the worker and keep the worker moving at a fast pace, such as in customer service centers or catalog order centers. The worker must also meet customer demands. Once one call is completed, the next one is queued up for the worker by the information system. These work systems give rise to job strain because the worker has little latitude in what is being done or how to do it, yet high psychological demands are created by production

requirements and customer demands. In many job strain studies, these types of jobs are classified as high strain, as shown in Figure 1. Hereafter, high strain will be referred to as the hazardous work condition created by combining psychological job demands and job decision latitude.

Job strain occurs in all occupations within all industries. Thus, there are certain common work system indicators of both psychological job demands and job decision latitude. Psychological job demands are the result of the amount of work a person has to do, the job's mental requirements, the need to coordinate multiple tasks and requests from multiple people in order to get the job done, and time constraints regarding how quickly the work must be completed. Job decision latitude is the combination of task authority and skill discretion. Task authority is the degree to which the worker controls how to do the job. In high-strain work, this authority can reside with the information system or other machine. For example, in the U.S. Postal Service, people who sort the mail typically work at large multiple-position letter sorting machines. The worker sits in front of a machine that automatically grabs a letter and puts it into a window for the worker to visually scan. This is done every second for 45 minutes. Based on the address, the worker keys in a code using a special keyboard that sends the letter through the machine into a bin on the other side of the machine. People in this job have no authority to determine how they do the work. It can also reside with a supervisor or even the customer. Skill discretion relates to the ability of the worker to be creative in the use of skills and the development of new skills. A worker whose primary job is data entry has the



potential opportunity to develop additional skills using other software if courses are available and work is organized to allow the person to take the classes and practice the new skills. Combining task authority and skill discretion to form job decision latitude captures to what degree workers have control over what they do and how they do it. This is also referred to as job control giving rise to the phrase demand-control model (DCM), a phrase often used instead of job strain.

The DCM predicts that high-strain work affects illness and disease in three possible ways (Karasek & Theorell, 1990): (1) a worker exposed to high-strain work on a daily basis will respond by releasing stress hormones that circulate in the blood. This physiological stress can increase the person's chances of developing high blood pressure and cardiovascular disease; (2) working in these conditions will cause psychological strains such as job-related tension, mental strain, and alienation that can lead to depression. Mental health problems like depression can also affect stress hormone levels, and (3) the psychological strain and physiological stress can lead a person to smoke, drink, abuse illegal substances, or have sleep problems. The emotional exhaustion can encourage sedentary behavior that can eventually result in obesity and the chronic health problems associated with obesity such as Type 2 diabetes.

The DCM shown in Figure 1 also predicts that work high in psychological demands and job decision latitude produces active learning and greater self-efficacy at work (Schnall, Belkic, Landsbergis, & Baker, 2000). The opposite of active work is passive work, where there are both few psychological demands and little job decision latitude. While less researched, this type of work may affect morbidity and mortality through the alienation and boredom it creates (Amick et al., 2002). In today's more dynamic economy, it

may also be a marker for job insecurity, since people in this type of work develop few skills on the job.

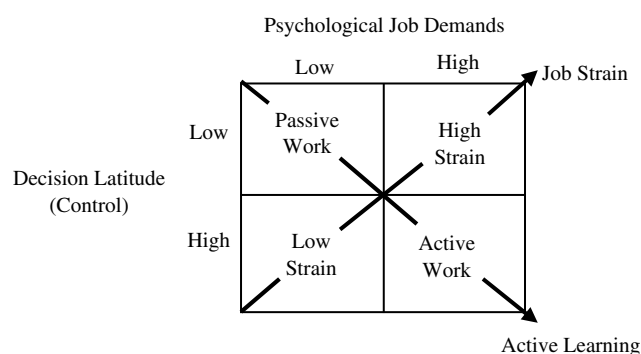
The public health implications of the DCM are threefold. First, high-strain work is a hazardous work condition. Second, passive work is a potentially hazardous work condition. Third, these hazardous work conditions can be improved through changes in work systems design that increase job control or psychological demands. Most important, work system redesign has been shown to be effective and to improve both satisfaction and productivity (see Capelli et al., 1997, for a discussion of work redesign).

## DEVELOPMENT AND DETAILS

The DCM was originally developed by Robert Karasek (1979). He identified the three factors (task authority, skill discretion, and psychological job demands) that combine to create the four work environments depicted in Figure 1, when analyzing the 1969, 1972, and 1977 U.S. Quality of Employment Surveys. The measures are part of a broader survey, the Job Content Questionnaire (JCQ), which has been translated into multiple languages (see Karasek et al., 1998, where information on permission to use the JCQ is available, or go to [www.uml.edu/Dept/WE/jcq.htm](http://www.uml.edu/Dept/WE/jcq.htm)). The original JCQ (version 1.1) was developed in 1985 and updated in 1995 (version 1.5). In the United States, a common approach is to use a reduced question set including nine questions on task authority and skill discretion and five psychological work demands questions. Workers respond by endorsing how much they agree or disagree with statements about their work (the response scale varies from *strongly agree* to *strongly disagree*).

Researchers from many countries have used the instrument. The measures demonstrate strong reliability across country and gender. Cronbach's alphas, a measure of how consistently all the questions used to measure the job demands and decision latitude scales relate to each other and to the scales, range from an average of 0.73 for women and 0.74 for men. (A successful scale has a Cronbach alpha of 0.7 or greater.) In the Cornell Heart Study, the test-retest reliability (i.e., the ability of people to answer the same questions at two points in time the same way) of both decision latitude and psychological demands were 0.64 (reported in Schnall et al., 2000).

Some researchers interested in job strain have been unable to ask workers to answer questions. For these



**Figure 1** Job Strain or Demand-Control Model

researchers, a job exposure matrix has been constructed in both the United States and in Sweden (Johnson & Stewart, 1993; Schwartz, Pieper, & Karasek, 1988). To create a job exposure matrix, individual answers to JCQ questions are aggregated up to the occupational level (e.g., carpenter, nurse, teacher). For example, the information from the 1969, 1972, and 1977 Quality of Employment Surveys was pooled to create a sample of 3,000 men and 1,500 women. This information can then be used in other studies where only a standard occupation measure, for example, the three-digit international classification of occupations, is known. Job decision latitude and psychological job demands exposures can be linked to individuals by using their occupational information. One advantage is that job strain can be studied in data sets that do not contain any self-reported information. A second advantage arises from the fact that the workers reporting health problems are not the ones reporting work conditions. Thus, there is no likelihood of exposure misclassification due to health, because those with health problems underreport job decision latitude or overreport psychological job demands. One disadvantage occurs because the variability in psychological job demands and job decision latitude is between occupations, even though there is a lot of within-occupation variability. For example, not all nurses do the same work, but they are in the same occupation. A nurse working in the operating room has higher levels of psychological job demands than a nurse working in a private practice. Similarly, a nurse in a private practice has higher levels of job decision latitude compared to an operating room nurse. When individual self-reported data exists, the operating room nurse will be classified as high strain, while the private practice nurse will be classified as low strain (see Amick et al., 1998, for an example of how nurses are classified with self-reported measures). This level of specificity is missed when only the occupation, nursing, is used where all nurses will be assigned the same score. It is commonly recognized that job decision latitude varies between occupations, but psychological job demands vary as much within as between occupations. Until methods are developed for objective job strain exposure assessment, self-report and job exposure matrix measures will both continue to be widely used.

In statistical analysis, three methods have been commonly used to estimate the risk of illness, injury, psychological state, or mortality. First, researchers

will create scales and then split the scales on the median to create the rows and columns in Figure 1. What results from this cross-classification are four groups: (1) high strain (jobs like bus driver, nurse's aide, or assembly line worker), (2) low strain (jobs like natural scientist, repairman), (3) active (jobs like physician, farmer, and bank officer), and (4) passive (jobs like janitor and night watchman). Scores above the job demands median and below the job decision latitude median are combined to create high strain. The high-strain group is compared to the low-strain group to estimate an effect as suggested by the arrow in Figure 1, yet often high strain is compared to all other groups. More recently, the active group is considered to have the "healthiest" work conditions and the other three groups are compared to it. This also allows estimating the passive work effect. Second, the job demands scale is multiplied by the reciprocal of the job decision latitude scale, and then those with the 20% highest scores are classified as high strain. This group is often termed "hazardous psychosocial work" and is compared to all other work. Hallqvist, Diderichsen, Theorell, Reuterwall, and Ahlbom (1998) have suggested that the best cutoff may be 10% to improve sensitivity of detecting biologically relevant exposure. Third, the psychological job demands measure is divided by job control to create a ratio. The ratio reflects a true measure of the ability of the person to use job resources to manage demands. The higher the score, the more likely the person is to be in a high-strain job. Researchers argue that this is more appropriate, since splitting measures on the median can lead to problems in hypothesis testing (Type II error).

Debate about measurement and analysis issues remain. Because of the implicit interaction of job decision latitude and psychological job demands, some researchers argue that the only appropriate way to estimate a combined effect is through including both main effects and interaction effects in the statistical model (Kasl, 1998). However, other approaches, such as estimating a synergy index (an approach to calculating a multiplicative interaction effect in epidemiology), have been used and may be as appropriate. Suffice it to say that at this moment, there is no single agreed upon method for job strain risk estimation.

A more recent concern is how to cumulate exposure over a person's working life. In most studies, job strain is measured at one point in time. Without

multiple points of measurement of job decisions latitude and psychological job demands, the duration of exposure cannot be estimated. Duration has been examined in 5-year periods by Johnson and Stewart (1993), while Amick and colleagues (2002) examined the complete working life course. To date, no evidence indicates how long a worker can do high-strain work and remain risk free.

## EXAMPLES

To illustrate the main high-strain hypothesis and the secondary active work hypothesis, two studies are briefly presented. As part of the Stockholm Heart Epidemiology Program (SHEEP), a case-control study of job strain and first hospitalization or fatal myocardial infarction, Hallqvist and colleagues (1998) used a synergy index to represent the multiplicative effects of decision latitude and job demands. These effects are hypothesized in Figure 1. When the synergy index is greater than 1.0, it indicates that there is greater than an additive effect of job decision latitude and job demands. A simple additive effect would not indicate a job strain effect. They found that the synergy index was 4.0, indicating a strong multiplicative effect.

Amick and colleagues (2002) prospectively examined the mortality risk for workers who spent their lives in high strain work or passive work. Figure 2 shows the study results. Using the median split methodology, a nonsignificant elevated risk for high-strain work

and a significant elevated risk for passive work were found. The results suggest that if workers spend their working lives in passive jobs, their chances of dying within 10 years following their last job are 35% greater than workers who spend their working lives in active jobs.

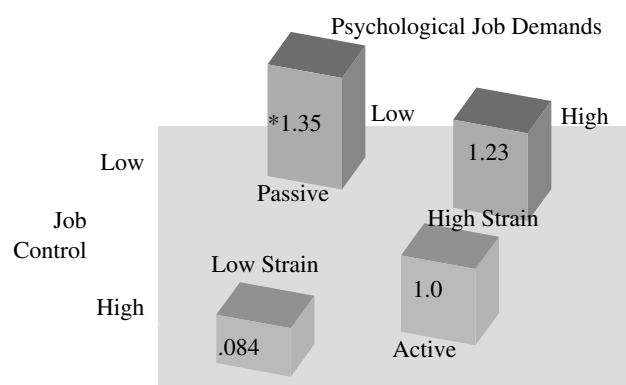
Both sets of findings indicate the importance of the broader conceptualization offered by the job strain model as opposed to the simple characterization of psychological job demands and job decision latitude.

—Benjamin C. Amick III

See also EFFORT-REWARD IMBALANCE; OCCUPATIONAL HEALTH AND SAFETY; WORK-RELATED STRESS AND HEALTH

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**Figure 2** Working Life Course Job Strain Exposure in a Nationally Representative Sample of U.S. Workers From 1968 to 1992<sup>a</sup>

a. Risk estimates adjusted for age, race, gender, year, family income, family size, retirement, unemployment, baseline disability. \* $p < 0.001$ .

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## JOHN HENRYISM AND HEALTH

As defined by James, Hartnett, and Kalsbeek (1983), John Henryism (JH) is a "strong behavioral predisposition to cope actively with psychosocial environmental stressors." The construct is characterized by three major themes: (1) efficacious mental and physical vigor, (2) a strong commitment to hard work, and (3) a single-minded determination to succeed. The JH model takes its name and is inspired in part by the story of John Henry, the "steel-driving man." According to the legend, John Henry was a widely admired African American railroad worker in the late 19th century who, in an epic steel-driving competition, defeated a steam-powered drill. However, soon after rallying his strength to win the contest, John Henry died suddenly from mental and physical fatigue.

For James, the fabled actions of John Henry served to illuminate the empirical literature describing the relation between psychosocial stress and hypertension among those of low socioeconomic status (SES). It is well known that lower SES populations are routinely exposed to chronic, unrelenting psychosocial and environmental stressors (i.e., low job control, financial difficulties, familial instability, discrimination, exposure to violence, lack of health care resources). In order to manage these persistent psychosocial stressors, some may adopt a high-effort or "active" style of coping, which may constitute an adaptive coping response among those with access to adequate educational or occupational resources. However, utilization of an active coping disposition may entail deleterious health outcomes among those without sufficient material resources (that may serve to buffer active coping efforts). Syme's (1979) seminal review posited that prolonged high-effort coping with adverse psychosocial

stressors might largely account for the inverse relation between SES and hypertension.

The JH hypothesis extends this literature by arguing that high JH may heighten the blood pressure of those in lower socioeconomic strata via the increased sympathetic nervous system arousal promoted by frequent high-effort coping. Or more formally, "the inverse association between socioeconomic status and blood pressure will be much more pronounced (i.e., more striking) for individuals who score high on JH than for those who score low" (James, 1994).

This entry reviews the theoretical underpinnings of the JH model, discusses empirical findings investigating the concept, and presents future directions for JH research.

## EMPIRICAL INVESTIGATIONS OF THE JH CONSTRUCT

James's group initially conducted three cross-sectional studies of the JH hypothesis in rural, eastern North Carolina. Their 1983 pilot study examined a sample of 132 Black men, aged 17 to 60, who were members of the poor, predominately African American community. Findings revealed that at high JH, low levels of educational attainment (< 12 years) were marginally associated with higher resting blood pressure. Though these results were not statistically significant, the findings suggested a need for additional investigation.

The initial study was also designed to validate an early version of the JH Scale of Active Coping (JHAC12). The 12-item, 5-point Likert-type scale measures the three primary JH themes. Five response options for each item extend from *completely true* to *completely false*. Each item is reverse-coded and summed to derive a total JH score that ranges from 12 to 60 (with higher scores representing higher levels of JH). The JHAC12 has demonstrated acceptable internal consistency in samples of Black and White men and women. Adult samples tend to score near the high end of the JHAC12 range.

The second of James and colleagues (1992) studies extended the pilot findings to a sample including Black and White men and women. Lower SES was marginally associated with increased blood pressure for Black but not for White participants. Similarly, JH was found not to be predictive among Whites. However, among low SES African Americans, high levels of JH were associated with higher resting

diastolic blood pressure and a threefold increase in hypertension prevalence. Surprisingly, the level of hypertension seen among high JH, high SES subjects was quite low, suggesting that among this rural population, high JH might protect against elevated blood pressure.

These early studies also demonstrated that JH was positively associated with a host of other lifestyle factors including life satisfaction, perceptions of good health, being married, having children, being employed, having a high-status, better-paying job, and church attendance. JH was inversely associated with education and age after adjustment for other demographic and psychosocial variables.

James's group focused their 1992 study on a much larger sample of African Americans from eastern North Carolina. The sample was drawn from a county that was more urbanized and socioeconomically diverse than in their previous studies. The traditional JH hypothesis was not supported. James reasoned, however, that the inverse association between SES and hypertension would be pronounced among low SES individuals who also reported higher levels of perceived stress. He suggested, though, that elevated perceived stress alone would be insufficient to spur elevated blood pressure. Rather, he argued (consistent with the JH model), that high effort coping with the elevated levels of perceived stress among low SES individuals would be associated with higher blood pressure levels. Indeed, post hoc analyses revealed significantly elevated blood pressure levels among low SES, high JH subjects, but only among those who reported high levels of perceived stress.

A host of other investigations have examined the influence of JH on measures of cardiovascular functioning. Wright and colleagues showed that high JH predicted higher blood pressure, higher total peripheral resistance, and lower resting cardiac index among Black and White adolescents. The highest levels of resting cardiovascular dysregulation were found among low SES adolescents who were high in JH. More recently, Merritt, Bennett, Sollers, Edwards, and Williams (in press) found that high JH and low education were associated with elevated diastolic and mean arterial pressure (MAP) responses and inhibited recovery responses to laboratory stressors.

Contrary to the traditional JH hypothesis, Light and colleagues (1995) found that high JH and high job status predicted elevated work blood pressure among women and Black adults. This was consistent with

findings by McKetney and Ragland (1996), who found that high JH young adults with high levels of educational attainment showed marginally higher resting blood pressure. In a sample of Nigerian civil servants, Markovic, Bunker, Ukoli, and Kuller (1998) found a nonsignificant trend toward higher blood pressure levels among higher SES workers with high JH.

Despite these compelling findings, a host of other studies have failed to support the JH hypothesis. As with any construct, null findings may be influenced by myriad potential confounding factors. With respect to JH, however, some themes have emerged. First, a number of investigators have examined the effect on health outcomes of JH in isolation. JH certainly has value as one of few empirically supported, culturally patterned coping models, and this empirical approach has proven fruitful in some studies. However, examining JH solely opposes the traditional JH hypothesis, which is posited as an interaction with SES.

Next, there has been significant reliance on objective indicators of SES (most often education and/or income) in JH studies. While low SES is a critical component of the JH hypothesis, objective measures do a poor job in differentiating the more proximate social, environmental, and psychological characteristics that may drive the utilization of the JH style (e.g., James's finding that the low SES  $\times$  high JH interaction predicted elevated blood pressure only among those reporting high levels of perceived stress). Thus, assessment of stressors in the home, occupational, and residential environment may prove efficacious in improving the predictive utility of the model.

Of some concern has been JH's external validity, a subject that has received little empirical attention. A major question is whether the JH construct can be applied outside of rural southern communities characterized by economic deprivation (where it has often been studied). With some exceptions, those studies utilizing more economically and geographically diverse samples have failed to confirm James's original JH hypothesis.

Finally, there does appear to be support for JH as a mode that is particularly relevant to the experience of African Americans. Many of the JH findings suggest that JH is more predictive of adverse outcomes among African Americans compared to Whites. The JH hypothesis has been confirmed almost exclusively in Black American populations, with the exception of a study conducted in a Dutch sample. Research

conducted among European Americans shows no consistent pattern.

## OTHER CONSIDERATIONS

### Gender

There is some evidence to suggest that the traditional JH hypothesis may better capture the experience of African American males. Although a number of studies have found no difference in JH scores between men and women, at least one investigation has explicitly examined whether gender differences in JH predict hypertension prevalence.

In a sample of 600 African American men and women, high JH men were approximately 50% more likely to be hypertensive than were high JH women. High JH women were actually at decreased risk for hypertension. Interestingly, there was no support for the traditional JH  $\times$  SES interaction, nor a three-way interaction with gender. This finding is consistent with those suggesting that women's coping behaviors are distinct from those of their male counterparts. Clearly, this issue deserves additional empirical attention.

### Job Status and Workplace Factors

Conceptually, occupational factors constitute a major component of the JH pattern. Few JH studies, however, have addressed workplace concerns specifically. James and colleagues studied the interaction between JH and a variety of workplace factors in the prediction of resting blood pressure. Among Black males they found that high job success was associated with lower diastolic blood pressure, but only among those with low levels of JH. High JH men who felt that being Black had hindered their job success were found to display elevated diastolic blood pressure and lower levels of perceived job success. James posited that low JH men may have been "less ambitious" in their perceptions of job success.

Light and colleagues' (1995) study examining the association between job status and JH extended these findings. Her sample was better educated (65% of whom were college graduates) and had significantly higher job status (roughly 72% held white-collar positions). Light's findings are notable because they challenge the traditional JH hypothesis—that high JH and low SES interact to affect blood pressure. In the study, Blacks with high status jobs (in comparison to White

men and women) displayed higher levels of both systolic and diastolic blood pressure at work (using ambulatory measurement) and at home (resting casual blood pressure). That the majority of Blacks with high status jobs were also high in JH (71%, compared to 36% for White participants) supports James's assertion that individuals high in JH may have higher occupational goals and aspirations than those low in JH. James, however, argued that the psychosocial stressors encountered with attempts to achieve and maintain these goals would be associated with deleterious outcomes among those of low SES. Light's extension to this argument suggests that such psychosocial stress may not be uniformly associated with SES, but also with ethnicity. Interestingly, however, and as Light notes, though individuals may place themselves at risk for elevated blood pressure, the JH behavior pattern may be a quite adaptive means of achieving higher perceived job success (while risking blood pressure elevations) when one is of high SES.

### Investigation of Biological Mechanisms and Clinical Outcomes

The JH model has been rigorously investigated in association with cardiovascular parameters, primarily blood pressure. These efforts, however, are far from comprehensive, given the model's potential association with other health outcomes not directly related to cardiovascular dysfunction. The increasing number of findings detailing the importance of the HPA-axis in mediating exposure to chronic stress and negative affect make it a useful domain for future investigation. A recent pilot study by Bennett, Merritt, Edwards, Sollers, and Williams (n.d.) demonstrated an association between high JH, high job demands, and dysregulated cortisol secretion. Other ongoing investigations are actively examining the relations between JH and other neuroendocrine parameters. Additional research is increasingly evaluating the utility of the JH model among clinical samples, including those with cancer and pain-related disorders.

### Refinement of the JH Assessment Instrument

The assessment of JH can, at times, present analytic and interpretive difficulties. Scores on the 12-item JH Scale Active Coping Scale (JHAC) are often quite high for both Blacks and Whites. These high-scale scores (normally averaging 50-54 out of 60)

have been found in many JH investigations and can make meaningful differences between high and low JH groups that are difficult to discern. James, Strogatz, Wing, and Ramsey (1987) attributed the high scores to the possibility of social desirability biases in the scale. High JH levels may be found because the construct taps factors such as hard work and determination, which are core American values (i.e., the Protestant work ethic). Some work has investigated the development of a JH-structured interview that would more systematically access the three key components of JH. Such an instrument, however, would not be useful in epidemiological investigations. Upcoming research is more vigorously examining the psychometric properties of the JHAC12.

## CONCLUSION

This entry has reviewed evidence linking the JH model and SES with health outcomes. Because African Americans have historically suffered a lack of directed research attention, many argue the importance of identifying and elucidating the unique characteristics accompanying ethnic minority status. Compelling both conceptually and in its empirical application, the primary strength of the JH model may lie in its transdisciplinary approach to the identification of factors responsible for the promotion of ethnic disparities in health outcomes. Despite the model's appeal, significant empirical questions remain that should spur a new generation of JH research.

—Gary G. Bennett

See also AFRICAN AMERICAN HEALTH AND BEHAVIOR;  
CULTURE AND HEALTH; HEALTH DISPARITIES; STRESS,  
APPRAISAL, AND COPING

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## KEY INFORMANTS

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The term *key informant* is best understood in the context of ethnographic or qualitative research in naturalistic settings (LeCompte & Schensul, 1999). These settings are often termed “the field” (DeWalt & DeWalt, 2002; Pelto & Pelto, 1978). The field is a sociophysical setting whose boundaries are defined in terms of institutions and people of interest and their associated activities in geographic space. For ethnographers, the field is any naturalistic geographic/social setting or location where a selected research problem is to be studied—a neighborhood, a network of clinics or emergency rooms, a group of buildings, or a school system. When ethnographic or qualitative researchers go to the field, they leave their own communities, institutional settings, and familiar behavioral and cognitive patterns to “enter” another social world—the world where the research will be conducted (Bernard, 2000; Miller & Crabtree, 1994; Werner & Schoepfle, 1987).

Ethnographic research is never “autobiographical.” It requires that the researcher separate stereotypes, opinions, and judgments from accurate or “objective” observation and effective recording of the words, meanings, and opinions of research participants. Researchers thus must recognize and suspend their biases (LeCompte & Schensul, 1999). “Entry” is more than *going into* a medical clinic, a crack house, or a school; it requires that researchers transform themselves into instruments of data collection. Ethnographic research calls for engagement in direct learning through physical and social involvement in

the field setting. Knowing, for ethnographers, is first and foremost experiencing by observing, participating in conversations and daily activities of members of the community under study, and recording these observations (Bernard, 2000; DeWalt & DeWalt, 2002). In the process, ethnographers learn what residents of the field already know—the language of the setting, the rules guiding social relationships, and the cultural patterns, expectations, and meanings that people share. Learning these rules, norms, boundaries, and behaviors is the task of ethnography. The first step in learning is establishing the relationships through which socialization can take place (Schensul, Schensul, & LeCompte, 1999).

The process of establishing personal relationships in the field is referred to as “building rapport” (Mischler, 1986; Schensul et al., 1999). Good ethnographers build trusting relationships easily. While sensitive to their surroundings and to appropriate timing especially with respect to sensitive questions (e.g., questions about sexual behavior or drug use), they quickly make efforts to ask questions that enable them to learn new things. One of the first steps in ethnographic field research in the field is the identification of those individuals who can help researchers to learn about the community and about the topic being discussed. These individuals, recognized as having special knowledge or expertise in a topic of interest to the researcher, are referred to as “key informants” (Bernard, 2000). Key informants are those knowledgeable individuals who are willing to share their knowledge with researchers once or repeatedly. According to Gilchrist (1992), “Key informants differ from other informants by the nature of their position



in a culture and by their relationship to the researcher which is generally one of longer duration, occurs in varied settings and is more intimate" (p. 71).

Some qualitative researchers are critical of the term *key informant*, suggesting that it is symbolic of the power that researchers have traditionally held over the communities or other settings in which research is conducted. They suggest that "outside" researchers partner with local experts in the generation of knowledge (Clifford, 1988; Marcus & Fischer, 1986; Reason & Rowan, 1990). Others feel that the term *informant* refers to someone who is informing outsiders about behaviors or beliefs that communities wish to keep private. These views reflect different opinions about the appropriate relationship of the researcher to the community of study and the potential power imbalance between researchers and those researched. However, the term *key informant* can apply to anyone with specialized information or expertise, regardless of the mode of relationship, balance of power, or approach to qualitative research the researcher prefers.

Key informants provide depth and breadth of information. Key informants may have broad knowledge of a community or service system (e.g., superintendents or elected officials). They may introduce researchers to networks of people involved in specific roles and activities (physicians, drug dealers, alternative healers). Features of social geography (locations of commercial sex workers, romantic beach sites or hotels, which pharmacies older adults use) can be readily explored with the appropriate key informants. They may have expertise in specific topics ("over-the-counter remedies for arthritis," new drug trends in the community). Interviews with key informants reveal the domains and some of the subdomains of culture (i.e., the broad "coding categories" to be explored in further interviews and observations) (Fontana & Frey, 1994; Miller & Crabtree, 1994).

Researchers seeking for key informants will find that administrators, friends of friends, public figures, and other gatekeepers or people who provide entry to the research site constitute the best sources of information. People researchers know and trust can tell which individuals might make good candidates for key informant interviews. For each key informant, the researcher should have information about their possible area(s) of expertise, how to locate them, whatever information is available about their lifestyle, associations, schedule, and contacts. Once contacted and

interviewed, each key informant may be able to suggest others with related expertise or connections to the community.

Spradley (1979), a well-known ethnographer, notes that "although almost anyone can become an informant, not everyone makes a good informant" (p. 45). What makes a good key informant? Good key informants are natural researchers, interested in the purpose of the research and in exploring the topic in their own settings, together with as well as in the absence of the ethnographer. They are able to relate to a variety of different settings, sectors, networks, and individuals, and are prepared to link the ethnographer with these informational resources. The best key informants are clear about the boundaries of their own expertise. They alert their research partners to their own knowledge gaps. Key informants are often risk takers, willing to associate with the ethnographer despite questions about the research and the identity and intentions of the researcher. Usually they are experienced, having lived for a number of years in the research setting.

Qualitative researchers often make the mistake of interviewing a key informant only once. A single interview can provide an orientation to a subject or community, but the information that can be obtained from the first 60- to 90-minute interview is limited. This interview provides ideas and clues that can be probed in repeat interviews over a much longer period of time. Key informants often play a central role in their communities or networks, and can be very helpful in deepening the researcher's knowledge, tracking trends, and introducing researchers to others. Developing trust takes time. The quality and depth and detail of information is generally directly related to the intimacy and trust that develops between a researcher and a key informant. There are numerous examples of key informants in the anthropological literature. A typical key informant is the young man who found it very interesting to discuss the evolution and structure of the drug trade in a northeastern city. He was proud of the development of his own drug-dealing networks, clear about his plans for the future, and able to provide much helpful information over time with respect to new drug trends, and problems presented by the introduction of new drugs into the urban setting (Schensul et al., 2000).

Researchers approach key informants for interviews with open-ended questions. In the case of a clinic administrator, for example, the first question

might be "Tell me about the kinds of health problems you see here." Subsequent questions might address location, types of patients/clients, where they go for help and services, how they manage their problems, the cost of help, difficulties in delivering services, and so on. Interviews are recorded by hand or by tape recording and transcribed verbatim. They are then coded by categories (such as those that constitute the above-mentioned topics of discussion) and subcategories as they emerge from the data. Interviews across key informants may be triangulated to verify already identified patterns and codes or to identify new ones (cf. Schensul et al., 1999). These interviews lead to further questions and more structured interviews with a larger sample of respondents to explore variations in the expression of cultural patterns or domains.

Key informants offer valuable information and emotional and social support to researchers new to a setting, as well as those seeking to explore new ideas and hunches with local experts. There are, however, limitations to the data that key informants provide. Information obtained from key informants must be complemented by other data sources such as interviews, observations, elicitation techniques, and surveys. Key informants do not represent every perspective in the community. They may also represent perspectives that diverge significantly from the norm. Furthermore, key informants may bias their information especially in the early stages of a relationship, when trust is evolving. Researchers must be able to situate key informants to interpret their contributions. Finally, researchers must triangulate a variety of data sources and seek for "saturation" (the point at which no new information is offered), in order to improve the validity of information provided by a single key informant source.

—Jean J. Schensul

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## KUOPIO ISCHEMIC HEART DISEASE RISK FACTOR STUDY

The Kuopio Ischemic Heart Disease Risk Factor (KIHD) Study is an epidemiological study of risk factors for atherosclerosis (a buildup of plaque in the arteries that can lead to heart attack and/or stroke), ischemic heart disease, related disorders (e.g., hypertension), and death in middle-aged and older adults from Kuopio, Finland, and surrounding communities. More than two decades ago, this area in eastern Finland was found to have one of the highest rates of

heart disease among men in the world. The KIID Study was designed to examine both traditional risk factors (e.g., cholesterol and blood pressure levels) and unknown or suspected risk factors (e.g., psychological characteristics) for cardiovascular diseases (CVD), in part to attempt to understand the high rates of heart disease in eastern Finland. When the study began in the mid-1980s, only males were invited to participate, in part because the high rates of heart disease observed in eastern Finland were noted in men, but also because at that time it was not as well understood as it is today that heart disease also is the leading cause of death in women. The most recent wave of data collection, obtained between 1998 and 2001, includes females in the study. Published findings from the KIID Study to date have demonstrated that several important social, psychological, behavioral, and biological characteristics influence the development and progression of heart disease in men and are associated with increased risk of dying.

## BACKGROUND

Dr. Jukka T. Salonen of Finland and Dr. George A. Kaplan of the United States jointly initiated the KIID Study in 1984. They designed the study to be one of the most comprehensive studies of risk factors for CVD ever conducted by including assessments of a large number of biological, behavioral, psychological, social, economic, and environmental characteristics thought to influence risk for atherosclerosis and heart disease. As such, the study is highly multidisciplinary, with investigators from many areas of medicine, public health, epidemiology, and psychology contributing to the study. The KIID Study was one of the first epidemiological studies to utilize state-of-the-art, noninvasive techniques to measure the extent and severity of atherosclerosis. Atherosclerosis is measured in the carotid arteries in the neck and the femoral arteries in the thigh. These sites are relatively easy to image with ultrasound technology, and plaque buildup in these sites is generally a good indicator of the overall amount of atherosclerosis found throughout the body.

KIID investigators use annual linkages with the Finnish National Death Registry, the Finnish Cancer Registry, the social security institute of Finland, and hospital discharge records to record the health status, work and retirement history, as well as the experience of heart attacks, strokes, cancers, and deaths of KIID

Study respondents. This multidisciplinary and comprehensive study has enabled investigators to address many previously unanswered research questions to better understand the development and progression of CVD.

## STUDY POPULATION AND PROTOCOL

The KIID Study originally recruited 2,682 men, who entered the study at the ages of 42, 48, 54, or 60 years old in two separate groups, called cohorts, over a 5-year period (1984-1989). All participants completed a comprehensive baseline examination that included interviews, paper-and-pencil questionnaires, laboratory tests, and physical measures. Four years later, a follow-up examination was undertaken on surviving members of the second cohort, with 1,038 men participating. KIID investigators completed a third examination on 854 surviving male respondents 7 years later, or 11 years after the baseline. At the same time, a cohort of 921 women, matched to the ages of the male participants (i.e., 53, 59, 65, or 71 years old), was enrolled in the study. The second and third examinations were comparable to the first and included comprehensive interviews, paper-and-pencil questionnaires, laboratory tests, and physical measures.

## HEALTH OUTCOMES

A primary goal of the KIID Study has been to assess the illness and mortality experience of the study population in relation to the broad array of risk factors that were measured. To track deaths among KIID Study participants, researchers annually link with the National Death Registry, which is maintained for all Finnish citizens. They also track the illness experience of study participants by reviewing hospital discharge records and/or performing annual linkages with medical databases. For example, to obtain information on the occurrence of heart attacks or stroke among study participants prior to 1993, data were obtained through the World Health Organization's Monitoring of Trends and Determinants of Cardiovascular Disease (MONICA) registry for this region. However, because the MONICA project, which had tracked cardiovascular events in 26 countries, including Finland, was discontinued after 1992, investigators have obtained more recent information on heart attacks and strokes via computerized linkages to the national hospital discharge registry in Finland. Linkage with the Finnish

Cancer Registry provides information about the type and severity of any cancers experienced by study participants. Investigators also have studied health conditions experienced by participants by collecting data on various health measures at each examination. These include assessments of systolic and diastolic blood pressure, noninvasive measurement of atherosclerosis of the carotid and femoral arteries, self-report of acute and chronic health conditions (e.g., diabetes, respiratory diseases), fasting levels of insulin, total cholesterol and lipoproteins, triglycerides, and markers of inflammation. Together, the breadth of information on health status obtained from these various sources has enabled investigators to report on the health status of KIID Study participants over time.

## KEY FINDINGS

KIID investigators have made important contributions to the understanding of the role that psychosocial factors play in CVD risk. For example, KIID Study research has shown that socioeconomic factors (e.g., education, occupation, income, childhood socioeconomic status), emotional states (e.g., anger and hostility, hopelessness, alexithymia), stress, and behavioral factors (e.g., alcohol consumption, smoking, physical activity, diet) critically influence the development and progression of atherosclerosis, hypertension, heart attack, stroke, and mortality. KIID investigators also have documented the important

effects that trace elements (e.g., serum ferritin, selenium, and mercury) and LDL oxidation have on these health outcomes, and have reported on the protective effects of antioxidants and on the influence of particular genetic polymorphisms and/or mutations on cardiovascular disease risk. Study results so far have been based on data from the male participants, but future reports from this study will examine how these risk factors affect the health of women.

—Susan A. Everson-Rose

See also ALAMEDA COUNTY STUDY; BOGALUSA HEART STUDY; FRAMINGHAM HEART STUDY; HARVARD ALUMNI HEALTH STUDY

## Further Reading

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# L

## LATINO HEALTH AND BEHAVIOR

Health and behavioral data for Latinos have become increasingly available, and significant progress has been made in data collection methods. Although national data are available to provide an overview of health behaviors among Latino populations in comparison to Blacks and non-Latino Whites, less information is available by Latino subgroup. The examination of health behaviors is conducted within the broader definition of health as the social, physical, and mental well-being of an individual. It is also acknowledged that individual health behaviors are associated with socioeconomic status (SES) and the community health resources available to individuals to maintain their health status.

This entry has three objectives: to provide an overview of health status indicators for Latinos; to present empirical data on health behaviors of Latinos by age, gender, and subgroup when available; and to propose a framework for knowledge building to promote a new public health discourse on Latino health.

### SOCIAL AND DEMOGRAPHIC PROFILE OF LATINOS

According to the 2000 census, 40 million Latinos live in the United States, representing 12.5% of the population. By the year 2050, Latinos are expected to constitute 25% of the U.S. population. Forty-five percent of Latinos live in the West, and 33% live in the South. Half of all Latinos live in just two states: California and Texas. Latinos are more likely to reside

in metropolitan areas (46.4%) than non-Latino Whites (NLW) (21.2%), and more likely than NLW to live in households of five or more people (30.6% compared to 11.8%). Latino children currently constitute more than 15% of the total U.S. population of children, and 21% are under 14 years of age.

Nearly 60% of immigrants of color have resided in the United States for more than 10 years, most becoming U.S. citizens during that time. Close to 39% of Latinos are immigrants, compared to 61% of Asian Americans and 6% of non-Latino Blacks (NLB). Almost 25% of Spanish-speaking persons living in the United States speak little or no English. Differences in language proficiency by geographic location correspond to variations by region of the labor market experience of Latinos. Latinos have the lowest high school completion rate among all ethnic groups. With 6.8% of Latinos in the civilian labor force unemployed, compared to 3.4% of NLW, those who are employed are more likely to work in service occupations (19.4%) than are NLW (11.8%). Only 14% of Latinos are in managerial or professional occupations—with Mexicans as the least likely subgroup at 11.9%—compared to 33.2% of NLW.

In 1999, 22.8% of Latinos were living in poverty compared to 7.7% of NLW. Puerto Ricans are the most likely of all Latino subgroups to live below the poverty line (25.8%). Latino (36%) and NLB (37%) children are 3 times more likely to be poor than NLW (11%) children. Fifty-four percent of Latinas are either poor or near poor.

Latinas have the highest birth and fertility rates. Among subgroups, Mexican American women have the highest birth (26.4 per 1,000) and fertility (112.1

per 1,000) rates, and Cuban American women have the lowest birth (19.0 per 1,000) and fertility (75.5 per 1,000) rates. Although 87% of Latino children are U.S. citizens, either born or naturalized, they have limited access to primary and preventive health services. Even after adjusting for family income and parental education, Latino children are significantly more likely than NLW children to have suboptimal health status, spend more days in bed for illness, and make fewer physician visits.

#### FIVE LEADING CAUSES OF DEATH FOR LATINOS

Although the top two leading causes of death for Latinos, NLW, and NLB are the same—heart disease and cancer—age-adjusted mortality rates for these two diseases are lower than rates for the total population, NLW, and NLB. Latinos have higher age-adjusted mortality rates for diabetes, homicide, chronic liver disease, and HIV infection than the total population and NLW. Puerto Ricans (406.1 per 100,000) have higher age-adjusted all-cause mortality rates than Cubans (299.5 per 100,000) or Mexican Americans (348.4 per 100,000). Puerto Ricans, 25-54 years of age, are particularly at increased risk of death compared to NLW, Cubans, and Mexican Americans.

#### ACCESS TO HEALTH CARE SERVICES

Latinos are the least likely to have health insurance of all racial/ethnic groups: 67% of all Latinos compared to 86% of NLW and 80% of NLB. These rates are lower for Mexican Americans (61%) than for Puerto Ricans and Cubans (81% and 79%, respectively). The percentage with usual source of care, a good measure of access to health care, mirrors these health insurance coverage rates. Mexican Americans are the least likely to have a usual source of care (75%). Twelve percent of Latino children under age 18 lacked a usual source of care, compared to 5% for NLB and 4% for NLW. Persons who cannot identify a regular or usual source of care are much less likely to obtain preventive services or diagnosis, treatment, and management of acute and chronic health conditions.

#### HEALTH STATUS

Recent surveys provide useful insights regarding the burden of disability and disease among the Latino

population. One measure, self-perceived health status, is a commonly used indicator of overall health status. Data from the National Health Interview Survey show that 16.2% of all Mexicans, 14.1% of all Cubans, and 17.5% of all Puerto Ricans report that they were in fair or poor health once differences in age distributions were taken into account—much higher than for the total population (10.8%) or NLW (9.3%).

#### CHRONIC HEALTH CONDITIONS

Less likely to use health services, Latinos with health conditions are also less likely to know that they have the disease. Although Latinos are more likely to develop diabetes than NLW (3.5 per 1,000 compared to 2.9 per 1,000), they are less likely to be aware that they have diabetes. The National Health and Nutrition Examination Survey (NHANES) found that 38% of Mexican Americans with diabetes were not previously aware that they had diabetes, compared to 33% of NLW.

NHANES data show that Mexican Americans are more likely to have high blood pressure (22% of Mexican American women compared to 19.3% of NLW women). Among diagnosed hypertensives, 12% of Mexican Americans had their blood pressure under control compared to 18% of NLW. The risks of the most common cancer sites—prostate, breast, and lung cancers—are lower for Latinos than they are for NLW. However, the incidence rate of cervical cancer was almost 1½ times higher for Latino women than for NLW women. The active asthma prevalence rate among Puerto Rican children (11%) is almost twice as high as that of NLB children (6%) and 3 times that of NLW children (3%).

Both Latino men and women have an AIDS case rate that is much higher than NLW men and women. Latinos' case rate is 58.2 per 100,000 compared to NLW case rate of 17.2 per 100,000, while Latinas' case rate is 16.6 per 100,000 compared to NLW women's case rate of 2.4 per 100,000. Given the higher risk of HIV/AIDS among Latinos, the lower rate of condom use by a partner among unmarried Latino women, 15-44 years of age, is of concern. Tuberculosis cases are also twice as high for Latinos (13.6 per 100,000) than the total population or NLW.

Latino adults are slightly more likely to report a major depression episode and Latino adolescents are slightly more likely to report a suicide attempt than

**Table 1** Preventive Health Care Behaviors (in percentages)

	<i>Hispanic</i>	<i>Mexican American</i>	<i>Non-Hispanic White</i>	<i>Non-Hispanic Black</i>
Teeth cleaned during past year ( $\geq 18$ years) <sup>a</sup>	64.4	—	73	64.8
Dental sealants				
8 years <sup>b</sup>		10	29	11
14 years	—	7	18	5
Routine doctor visit in past year ( $\geq 18$ years) <sup>c</sup>	67.1	—	71.7	81.6
Pap smear in past 3 years ( $\geq 18$ years) <sup>c</sup>	86.2	—	87.1	88.5
Mammogram within past 2 years ( $\geq 50$ years) <sup>c</sup>	83.6	—	79.8	83.5
Blood pressure checked during past year ( $\geq 18$ years) <sup>a</sup>	82.9	—	88.7	91.7
Fully immunized 19- to 35-month-old children <sup>d</sup>	69	—	76	68
Flu shot in past year (age adjusted, $\geq 65$ years) <sup>e</sup>	52.1	—	65.5	48.3
Pneumonia shot in past year (age adjusted, $\geq 65$ years) <sup>f</sup>	33	—	57.9	34.6
Cholesterol checked ( $\geq 18$ years) <sup>e</sup>	64.4	—	76.4	69.9
Ever had blood stool test ( $\geq 18$ years) <sup>e</sup>	20	—	33.1	25.9
Aspirin therapy among persons with diabetes $\geq 15$ times per month (age adjusted, $\geq 40$ years) <sup>f</sup>	—	8	25	8
Prenatal care during first trimester <sup>g</sup>	74.4	72.9	88.5	74.3

Sources: a. 1999 Behavioral Risk Factor Surveillance Survey; b. 1988-1994 National Health and Nutrition Examination Survey; c. 2000 Behavioral Risk Factor Surveillance System; d. 2000 National Immunization Survey; e. 2001 National Health Interview Survey; f. 1988-1994 National Health and Nutrition Examination Survey; g. 2000 Natality, National Vital Statistics System.

NLW. Living in the United States is related to elevated risk for mental health problems—Mexican American adolescents and adults living in the United States have higher rates of depressive symptoms, illicit drug use, and suicidal ideation than Mexicans. Schizophrenia rates are slightly lower among Latinos than NLW. However, Latinos with mental illness (e.g., depression, schizophrenia) are less likely to receive treatment for their illness.

#### PREVENTIVE AND RISK HEALTH BEHAVIORS

Lack of access to health care also impedes usage and participation in preventive behaviors and services, among them, routine check-ups, Pap smears, mammograms, clinical breast exams, and prenatal care. Consistent evidence shows that individuals who practice one preventive behavior are more likely to practice other preventive behaviors. When exploring likelihood of screening mammography, women who engaged in such preventive health measures as Pap smears, cholesterol measurement, and seat belt use

were more likely to obtain screening mammography. Evidence shows that access to health care (insurance) and engaging in other healthy behaviors were more important predictors of preventive behaviors than ethnicity.

Rates of preventive health care behaviors for Latinos are consistently lower than for NLW and similar or lower than for NLB (see Table 1). Considerable effort has been made during the past few years to encourage women to have breast checks, mammograms, and Pap smears. This has resulted in an apparent elimination of disparities in use of these services for Latinas, yet these data may not reflect rates for Latinas who are migrant farm workers, seasonal workers, or distressed inner-city residents. In 2000, 86.2% of Latinas 18 years of age and older had received a Pap smear during the previous 3 years; 83.6% of Latinas over the age of 50 had received a mammogram.

Table 2 presents national data on risk and preventive health behaviors among Latinos. These data demonstrate that the pattern of higher rates of diabetes among Latinos is likely to continue given the

**Table 2** Risk and Preventive Health Behaviors (in percentages)

	<i>Hispanic</i>	<i>Mexican American</i>	<i>Non-Hispanic White</i>	<i>Non-Hispanic Black</i>
Folic acid consumption by nonpregnant women $\geq 400$ mcg daily (15-44 years) <sup>a</sup>	—	13	23	18
Fruits $\geq 2$ daily servings <sup>b</sup> (age adjusted, $\geq 2$ years)	32	29	27	24
Vegetables $\geq 3$ daily servings <sup>b</sup> (age adjusted, $\geq 2$ years)	2	2	(3% U.S.)	—
Saturated fat intake $< 10\%$ caloric intake (age adjusted, $\geq 2$ years) <sup>c</sup>	—	39	35	31
Calcium intake $\geq$ mean intake (age adjusted, $\geq 2$ years) <sup>c</sup>	—	44	49	30
Smokers (age adjusted, $\geq 18$ years) <sup>d</sup>	16	—	24.5	22.2
Environmental tobacco smoke exposure among nonsmokers (age adjusted, $\geq 4$ years) <sup>c</sup>	—	53	63	81
Overweight (6- to 19-year-olds) <sup>c</sup>	—	15	10	14
Obese adults (age adjusted, $\geq 20$ years) <sup>d</sup>				
Men	22.1	—	22.5	27.5
Women	26.8	—	20.5	36.7
At least 1 drink during past month ( $\geq 18$ years) <sup>e</sup>	49.7	—	56.3	44.7
Driven with too much to drink ( $\geq 18$ years) <sup>f</sup>	5.6	—	4.3	3.7
Five or more drinks at one occasion $\geq 12$ times per year (age adjusted, $\geq 18$ years) <sup>d</sup>	8.3	—	10.7	5.3
No alcohol and illicit drugs during past month (12-17 years) <sup>f</sup>	79	—	77	82
No leisure time physical activity (age adjusted, $\geq 18$ years) <sup>d</sup>	78.9	—	65	75.1
Vigorous physical activity (Grades 9-12) <sup>g</sup>	61	—	67	56
Responsible sexual behavior (Grades 9-12) <sup>g</sup>	84	—	85	84
Condom use by partner, unmarried females (18-44 years) <sup>h</sup>	17	—	24	22
Have functional smoke alarm on every floor in residence (age adjusted) <sup>i</sup>	81	—	89	86

Sources: a. 1991-1994 National Health and Nutrition Examination Survey; b. 1994-1996 Continuing Survey of Food Intake by Individuals, USDA; c. 1988-1994 National Health and Nutrition Examination Survey; d. 2001 National Health Interview Survey; e. 1999 Behavioral Risk Factor Surveillance Survey; f. 1998 National Household Survey on Drug Abuse; g. 1999 Youth Risk Behavior Surveillance System; h. 1995 National Survey on Family Growth; i. 1998 National Health Interview Survey.

higher risk of overweight among Latino children and adolescents, the high rates of obesity among Latino adults, and low rates of leisure-time physical activity. Latino rates of alcohol consumption are intermediate between those of NLW and NLB. Current smoking rates, and rates of exposure to environmental tobacco smoke among nonsmokers, are lower for Latinos than NLW and NLB. Although educational campaigns to increase folic acid consumption among women of reproductive age target all women and those living along the U.S.-Mexico border, nonpregnant Latinas

15-44 years of age (13%) are still less likely to consume the recommended level of folic acid (at least 400 mcg per day) than NLW and NLB women (see Table 2).

Linked to self-care practice and preventive behaviors is belief in susceptibility, self-efficacy, and health locus of control. Self-care education could increase individuals' internal health locus of control, thus leading them to choose self-care over medical care or no care in the face of certain common illness symptoms. For example, Mexican-born women were less likely



to perform breast self-exam than U.S.-born women of Mexican descent not only because of lower SES, lack of health insurance, fewer health professional interventions, and less motivation to engage in other self-care practices, but also because they had a stronger belief in their perceived susceptibility to cancer and its seriousness and had a stronger belief in the role of fate and powerful others (physicians) in determining their health.

Disparities persist in rates of preventive health care behaviors, particularly for the use of flu and pneumonia shots among the elderly. Use of dental sealants for 8- and 14-year-old Latinos is half that of NLW. As documented in the Institute of Medicine's recent report *Unequal Treatment* (Smedley, Stith, & Nelson, 2002), Latinos have lower access to quality health care even within similarly insured populations. These disparities are more pronounced for newer diagnostic and treatment procedures. For example, only 8% of Latinos with diabetes who are at least 40 years of age take aspirin at least 15 times per month—one third of the rate for NLW.

## SOCIOCULTURAL PROTECTIVE BEHAVIORS

Health disparities are buffered at times by protective factors, which include ethnic-specific values and behaviors that are culturally sanctioned. Protective behaviors such as reliance on family members for information and instrumental support, low-fat nutritious eating habits, attitudes and value on motherhood and children, and low use of alcohol, tobacco, and illicit substances have not been adequately measured, with few exceptions, in prior studies. These health behaviors and psychosocial resources represent important mediators in understanding health disparities.

Although Latinos currently have lower rates of heart disease and stroke, there are two trends that are of concern. The first trend is that while Latinos' rates of obesity, diabetes, and high blood pressure are higher than NLW groups, they are less likely to engage in leisure-time physical activity. The second trend is that U.S.-born Mexican Americans have higher rates of certain risk factors such as smoking and alcohol consumption than those born in Mexico. These trends may lead to higher rates of heart disease and stroke for Latinos, which has been observed in recent studies.

The San Antonio Heart Study used Framingham risk equations to predict cardiovascular disease

(CVD) risk in Mexican Americans. The follow-up of the San Antonio Heart Study found a 38% higher all-cause mortality rate and a 30% higher CVD mortality rate for Mexican Americans as compared to NLW. While U.S.-born Mexican Americans showed greater mortality rates than NLW, Mexican immigrants did not. In explaining the excess risk for U.S.-born Mexican Americans, Stern and Wei (1999) concluded that immigrants from Mexico had very low mortality despite low SES due to a "healthy migrant effect," that is, the role of the protective factors that Mexicans bring with them. These findings point out the importance of conducting longitudinal studies for Latinos and analyzing results by birthplace/generation.

Noteworthy is that some studies show that as low-income Latino immigrants integrate into society, as measured by number of years in the United States and English-language proficiency, we observe a deterioration of protective factors, resulting in Mexican Americans and other Latinos becoming more likely to smoke, drink alcohol, be overweight, and have diabetes. Although these observations appear to be generalizable for all immigrants, for Latino immigrants—often living in greater degrees of poverty than other immigrants—the decrease in protective factors increases their burden of disease and disability.

Recent data show that U.S.-born Mexican Americans with higher education and English-language proficiency tend to have better health outcomes, while less educated U.S.-born Mexican Americans have worse health outcomes. These intra-group differences may be a function of their higher SES and greater access to health care services, while the less favorable outcomes of poor U.S.-born Mexicans may be explained by both their lower SES and the stressors associated with the continual process of acculturation. Perceived social acceptance—one measure of acculturation—should be explored as a possible predictor of service use, particularly preventive health services. Arcia, Skinner, Bailey, and Correa (2001) found that perceived social acceptance is a measure of perception, not of cultural behavior, and is therefore independent of language use, proficiency, and the cultural orientation of current or desired environments. Lack of social receptivity is a form of institutional discrimination and influences individuals' choice of their degree of active participation in society.

Protective behaviors may contribute to lower levels of perceived stress by the Latino community and may mitigate the detrimental effects of poverty on

health status and outcome, particularly for Mexican immigrants. The relatively good health outcomes of Mexican-origin individuals may in part result from the protective effect of strong family and cultural ties, social behaviors, the healthy migrant effect, and underreporting of mortality and poor birth outcomes due to misclassification of Mexican-origin individuals on death certificates. The Latino or Mexican “epidemiologic paradox” (exemplified by high poverty but favorable infant mortality and low birth weight rates) has been coined in reference to the similar birth outcomes of Mexican-origin women with NLW women, and more recently for the entire Latino population. Latinas born on the island of Puerto Rico experienced fewer stressful life events and were less likely to engage in negative health behaviors during pregnancy than U.S.-born Puerto Rican women, despite such risk factors as low human capital, meager financial resources, and residence in disadvantaged neighborhoods. The healthier outcomes may be accounted for by such protective factors as strong family support and a Latino cultural orientation.

Health behaviors such as sleep, nutrition, exercise, and substance use can be highly associated with family cohesiveness, environment stressors, perceptions of health status, value of health, and definitions of taking care of one’s health. Family cohesiveness has also been linked to disease management, with high levels of family cohesiveness resulting in good diet and exercise. More complete measures of culture-specific protective factors that promote favorable health behaviors and reduce risk behaviors require additional attention and inquiry.

The study of the role of culture-specific behaviors and female kin in differences in infant outcome between Mexican American and Mexican immigrant mothers shows that the extended family kin network and the women’s perception of the infant as important to her role in life are positively associated with her self-care practices. Similar conclusions were drawn by Mendias, Clark, and Guevara (2001), who found that women of Mexican origin living in the United States perceive themselves primarily as mothers and wives—highly valued roles in Mexican culture—and, because they see the family and their role in the family as important, they believe their own health to be important. Other studies have found that life events and perceived stress can influence birth outcome and use of alcohol, tobacco, and illicit substances. The impact that psychosocial factors, such as stress and depression, have on specific health habits can be

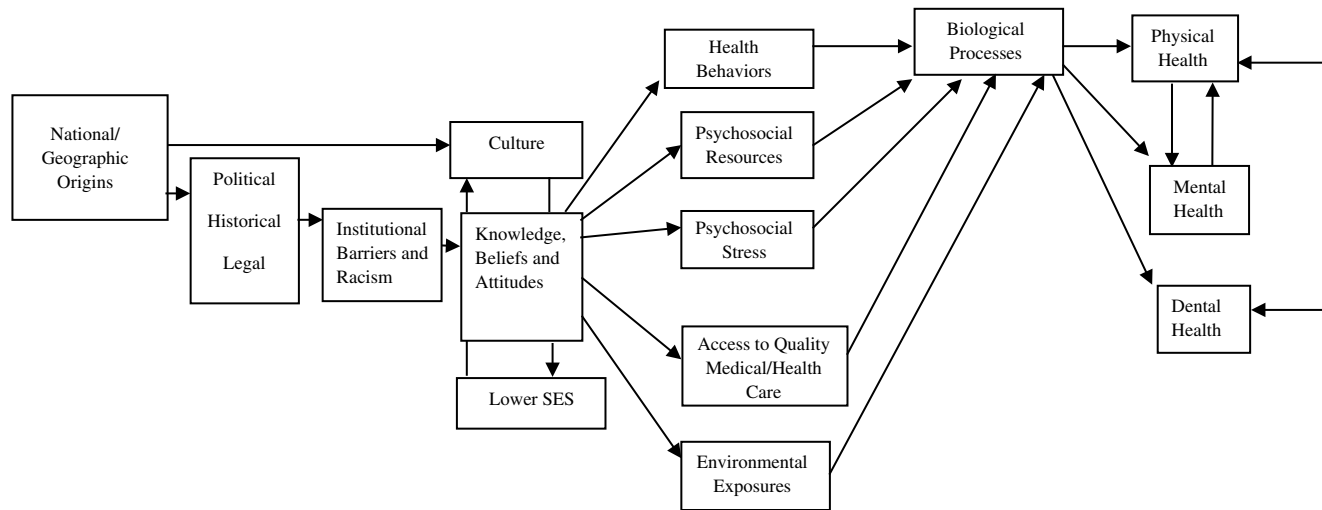
linked to a sense of powerlessness that is directly related to many poor health behaviors and negative attitudes toward the health care system.

Although stress is associated with community-level effects and depression, the role of social support shows highly variable results. For low-income Latinos, economic strain and worry, risk of violence and danger in the community, and institutional discriminatory practices are all highly stressful. These psychosocial antecedents as mediators in Latino health merit inquiry. Health behaviors, such as substance abuse, are highly related to stressors, and parental depression is highly associated with the aforementioned factors, less healthy behaviors, and less favorable health and well-being outcome for their children. Recent national data demonstrating Latino heterogeneity in health behaviors and outcomes provide an important opportunity to propose a framework for guiding the new generation of research.

#### LINKING THE FACTORS THAT CONTRIBUTE TO LATINO HEALTH BEHAVIORS AND OUTCOMES

The integration of multiple frameworks can provide a broader understanding of the dimensions of difference in health behaviors and outcomes among Latino subgroups and inform public health interventions to promote progress in reducing social class and racial and ethnic-specific disparities. Some consensus exists in the scientific public health community that multiple factors—economic, biological, environmental, psychosocial, access to health care and quality of services received, institutional racism, and political, legal, and structural factors (e.g., lack of outreach, immigrant and migrant status)—contribute to health outcomes. Evidence-based literature suggests that poverty is associated with a cluster of negative quality-of-life effects that are detrimental to health behaviors and outcomes. These include such health risks as undetected chronic or infectious diseases, nutritional deficiency, poor work conditions, unfavorable environmental and housing conditions, and racial and institutional discrimination, all of which contribute to chronic stressors in a support-limited environment. For example, 14.2% of Mexican American families reported food-insufficiency, compared to 6.7% of NLB and 2.1% of NLW.

In many ways, the acknowledgment of the multiple effects of poverty on quality of life and health



**Figure 1** Framework for Understanding the Relationship Between Hispanic/Latino Ethnicity and Health

Source: Adapted from Williams, D. R. (1993). Race in the Health of America: Problems, Issues, and Directions. *MMWR*, 42, RR-10, 9.

outcome is not new to public health. The role of poverty has been, however, elevated as an important factor (under the rubric of social inequality, privilege and health, SES gradient) in understanding health outcomes of low-income groups.

Studies have failed, however, to examine the multi-system-level factors that are linked to individual, family, and community health and that contribute to health disparities in poor, Latino subgroups. There is ample evidence to suggest that limited economic and educational resources contribute to less nutritious eating habits, less access to appropriate health care resources, especially for low-income Latinos, higher rates of drug and alcohol use, and less access to quality education, sanitation, and safety services.

Factors associated with Latino health access and mortality and morbidity patterns suggest that preventive, risk, and protective health behaviors intersect to influence health outcome. However, the protective factors also seem to decrease with persistent intergenerational poverty and changes in family structure variables. When data are available by subgroup, Puerto Ricans and Mexicans have the worst rates among Latinos for many health indicators, including self-assessed health status, percentage of population below the federal poverty level, adolescent birth rate, and infant mortality rates. These subgroups are more multiracial than other Latino subgroups, and their poorer health outcomes illustrate the intersectional effects of

racial and ethnic status on health disparities in the United States. Differential effects of preventive, risk, and sociocultural protective behaviors are linked with subgroup membership.

Figure 1 proposes a set of direct and mediating variables that may contribute to elucidating the relationship between Latino ethnicity and health outcome (with the caveat that the strength of each variable will be dependent on age, race, gender, access to health care services, and subgroup membership). The framework accounts for the unique political, social, and structural factors that Latinos in general, and underserved Latino subgroups in particular, confront in U.S. society.

Latinos share different modes of historic incorporation, different forms of institutional responsiveness and treatment based on national/geographic origin, race, indigenous background, SES, and dominant language spoken. The political, historical, and legal context of the position of each Latino subgroup has directly shaped the nature and extent of the institutional barriers and racism that are strongly associated with the disproportionate number of Latinos in poverty. For example, Black Puerto Ricans and Dominicans have lower SES and worse health outcomes than other Puerto Ricans and Dominicans. Low SES or poverty is strongly linked with individual factors such as knowledge and beliefs about their symptoms, health care practices, attitudes toward the health

care system, adherence to recommended treatments, and health behaviors toward seeking, accepting, and using health care services. These can be associated with individuals' perception of their social acceptance, which can be more a measure of institutional discrimination than of any of the individuals' characteristics.

These individual factors are strongly shaped by low educational levels and lack of access to relevant knowledge as a result of limited English-language and literacy proficiency and cultural-specific context. Although sociocultural factors may play a role in disease susceptibility, few studies have expended any effort in explaining how culture may be injurious or protective to health. Identified protective health factors include favorable health practices and psychosocial resources in the form of family, community, and societal support. In contrast, the rates of protective factors may decrease with time in the United States. Although risk factors are similar for all groups, risk factors are usually linked with ethnic-specific groups due to their context of poverty and health-delimiting correlates, limited access to health care, and the community context (such as exposure to violence, environmental pollutants). Jointly, these aforementioned factors contribute to psychosocial stressors. Accordingly, these risk factors for Latinos may contribute to changes in biological processes, such as higher rates of diabetes and cardiovascular diseases. The cumulative effects of these processes intergenerationally are likely to influence the overall well-being and health outcome of Latinos.

#### IMPLICATIONS FOR PROMOTING HEALTH BEHAVIORS AND ADVANCING LATINO HEALTH RESEARCH

A new theoretical discourse on the role of SES (poverty), not culture, may help to dispel the cultural attribution and deficit model that has dominated the public health literature on Latinos. The greater likelihood of living in poverty places Latinos at increased risk of disease and disability. Poverty is significantly associated with residence in resource-poor neighborhoods, greater likelihood of being exposed to environmental and occupational hazards, and greater likelihood of intentional and unintentional injury. Social environments can be linked to high levels of perceived stress, low levels of family cohesion and stability, and feelings of powerlessness, leading to low self-efficacy. These psychosocial variables may be

associated with poor health behaviors and health outcomes, as Phillips (1994) found when examining factors associated with healthy and unhealthy eating habits and intent to change eating habits among low-income, ethnic minority groups.

A major implication is that reduction in health disparities requires interventions to reduce poverty and increase access to health-promoting resources. For example, family economic security should be increased for low-income working poor by providing a living wage and a comprehensive form of family support for health, day care, and job development.

Future research on Latinos must be grounded in a more comprehensive "reality-based" conceptual context that accounts for resource-poor community contexts, racism, and discrimination in accessing health care so as to supplement the few studies identified by the recently released Institute of Medicine study, *Unequal Treatment*. Equally important are developing a health research agenda and funding priorities that are relevant and consistent with health data that show a disproportionate impact on Latinos, including ambulatory-sensitive conditions, diabetes, asthma, and obesity, and incorporate a more comprehensive view that includes the social, physical, and economic environment. A national strategic data collection plan requires implementation to monitor the health status and behaviors of Latinos by birthplace, subgroup, gender, and urban/rural residence and includes the residents of Puerto Rico. Community-based participatory research principles should be incorporated in all human subject research conducted with state or federal funds. Community-based participatory research studies should be monitored to ensure that the researchers engage and sustain a solid partnership with the community to ensure appropriate interpretation of the data.

Significant progress has been made in mapping and profiling the overall health status of Latinos in the United States in the past decade. The national disease prevention and health promotion agenda for the year 2010, Healthy People 2010, now has "eliminating disparities" as one of its two overarching goals. For the first time, single targets are set for all racial and ethnic groups and baseline and monitoring data will be routinely published for Latinos and other racial/ethnic groups. This is an important first step toward achieving the goal of eliminating health disparities. Considerable effort is now needed to better understand the factors associated with health behaviors so

as to improve our understanding of the reasons underlying ethnic specific disparities.

—Ruth E. Zambrana and  
Olivia Carter-Pokras

See also ACCULTURATION AND HEALTH; AFRICAN  
AMERICAN HEALTH AND BEHAVIOR; ASIAN  
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## LIPIDS: PSYCHOSOCIAL ASPECTS

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Lipids are fats that circulate in the blood, and include cholesterol, triglycerides, and phospholipids. Lipids are usually transported in the blood from one tissue site to another in the form of lipoproteins, which are combinations of lipids and proteins. The most well-studied and clinically relevant of these lipoproteins are high-density lipoprotein (HDL) and low-density lipoprotein (LDL), but the major lipoproteins also include chylomicrons, very low density lipoprotein, intermediate-density lipoprotein, and Lp(a). Total cholesterol concentrations include cholesterol from all of the lipoproteins. Because about 70% of cholesterol in the blood is carried by LDL, there is a strong relationship between LDL-cholesterol and total cholesterol.

Lipids play a central etiological role in atherosclerotic cardiovascular disease (CVD). Evidence from epidemiological studies, clinical investigation, and basic science research has concluded that persistently elevated concentrations of total cholesterol, LDL-c, and probably triglycerides predispose individuals to higher risk of developing atherosclerotic heart disease and thrombosis, and high concentrations of HDL-c are cardioprotective.

### DETERMINANTS OF LIPIDS

Both genetic and behavioral factors have influences on lipid and lipoprotein concentrations, and the influence is about equal in magnitude. Among the most important genetic influences are gender, inherited factors, ethnicity, and age. However, it is the

behavioral factors that affect lipid levels that are of particular interest to behavioral scientists. For example, moderate alcohol consumption and exercise each modestly increase HDL-c with little or no effect on cholesterol or LDL-c. The use of exogenous estrogens in women also increases HDL-c in addition to lowering LDL-c levels. In contrast, cigarette smoking lowers HDL-c, and obesity and a diet rich in saturated fat increases LDL-c somewhat. However, even when considered together, these genetic and behavioral factors explain less than half the variability in lipid levels between individuals.

Anxiety and depression have been implicated in the development and progression of CVD, although the mechanisms linking these variables to disease end points are not known. Because much of the variability in lipid levels is also unexplained, investigations of how and whether mood states, such as anxiety and depression, are associated with lipid concentrations have been initiated.

## MOOD AND LIPIDS

Several different mood states have been examined in relation to cholesterol and other lipids. These include depression, anxiety, hostility and aggression, and impulsivity, although the majority of the work in this area has focused on depression and anxiety. For example, depression has typically been found to be associated with low cholesterol levels, while anxiety is typically found to be associated with high cholesterol levels, as discussed below. While these general patterns in the literature have emerged, there is still no definitive consensus regarding the mechanism linking mood and cholesterol, and the nature of the causal relationship between mood states and lipid levels is not yet known.

The lifetime incidence of depression in the United States today is approximately 13% in men and 21% in women, and is increasing. Depression is a significant risk factor for death among cardiac patients, although the mechanism linking depression to risk of death is not yet adequately explained. Studies of depression and cholesterol levels generally have focused on a few, separate groups of individuals. Either clinical depression or dysphoria has been examined among healthy, hypercholesterolemic patients enrolled in lipid-lowering (primary prevention) trials; among cardiac patients enrolled in lipid-lowering (secondary prevention) trials; among large groups of healthy

individuals enrolled in epidemiological studies; among postpartum women who experience a prominent and sudden drop in blood cholesterol after giving birth; and among one or a few hypercholesterolemic individuals (single-case study) undergoing pharmacological lipid lowering. Relatedly, cholesterol concentrations have been examined in psychiatric patients at elevated risk for suicide.

Most lipid-lowering trials have revealed the expected decrease in cardiovascular-related deaths but also a surprising increase in non-illness-related mortality primarily due to an increase in deaths from suicide, homicide, accidents, and violence. Although the findings are intriguing, these large trials have not been adequately designed for the examination of psychiatric outcome measures, and the link between non-illness-related mortality rates and mood simply cannot be adequately tested in these studies. However, they have provided a clear rationale for smaller-scale investigations to specifically test the putative relationship between cholesterol and negative mood.

The majority of these investigations have reported an inverse relationship between cholesterol and depressive states, and this holds for studies of those with spontaneously low cholesterol as well as for investigations of hypercholesterolemic individuals undergoing lipid lowering. However, there are some disparate results, with a few studies showing no relationship, and even a few showing a positive relationship. All of these investigations tend to vary with regard to the assessment of depression, the use of psychiatric versus healthy populations, and various, likely important characteristics of the population examined (gender, age, ethnicity).

The investigation of postpartum women, although small in number, has reported more consistent findings. Pregnancy increases cholesterol concentrations by about 40%, and blood levels of cholesterol drop rapidly following birth. Most, although not all, studies of healthy women have shown a moderate, inverse relationship between serum cholesterol levels and depressed mood in the postpartum period. Thus, these data support the notion that precipitous decreases in blood cholesterol have negative effects on mood, and thus suggest that the change in lipid concentrations is causing the mood effects.

The findings for anxiety patients are in contrast to those among depressed patients. Generally, elevated total cholesterol levels have been reported among subjects with anxiety disorders, particularly panic

disorder. This is somewhat difficult to reconcile with the data on depression, because anxiety and depression frequently coexist. Thus, several investigators have examined blood cholesterol levels among patients with both anxiety and depression. Among those with major depressive disorder, the presence of current or past anxiety diagnosis is associated with increased blood cholesterol. However, those with a diagnosis of generalized anxiety disorder or panic without depression have higher blood cholesterol than those with a diagnosis of anxiety disorder or panic with comorbid major depression. In general, a relationship between trait anxiety and lipid levels in individuals without anxiety disorders has not emerged.

What might explain these sometimes contradictory findings? At least some of the discrepancies can be explained by examining the specific populations tested. For example, evidence for a relationship between transient depressed mood and lipid levels among nondepressed populations is stronger than is the evidence among clinically depressed patients. Evidence for a negative relationship between cholesterol and depressed mood among those treated for lipid lowering is more consistent among primary prevention trials than among secondary prevention trials. At least one study has determined that age is an important determinant of the relationship between cholesterol and depression; a negative association of lipid levels and depression was found only among older individuals. With regard to anxiety, the presence or absence of comorbid depression is an important factor to consider, as is the presence or absence of sleep panic. Finally, uncovering the causal relationship between cholesterol and mood states will clarify the mechanisms involved.

## MECHANISMS

How do psychosocial factors influence lipid concentrations in the blood? Anxiety, depression, and hostility, as well as stress, may exert influences on lipids directly, indirectly, or both. For example, stimulation of the sympathetic nervous system, as occurs during anxiety, aggression, and with some other mood states, increases blood pressure, catecholamine concentrations, and cortisol release. Ultimately, lipolysis, or the release of stored lipids into the circulation, occurs, resulting in changes in circulating lipid levels. Arousal of the autonomic nervous system also alters lipid metabolism by influencing regulation of lipoprotein

lipase and hepatic lipase, the enzymes responsible for the metabolism of specific lipoproteins. Cholesterol influences neuronal membranes, and can influence the production and metabolism of several neurotransmitters. The best documented of these effects is the reduced serotonergic function that occurs with decreased cholesterol levels. Serotonin has prominent effects on mood, such as depression, aggression, and impulsivity, and thus provides a putative mechanism linking decreased cholesterol with negative mood states.

More indirectly, affect and mood changes alter behaviors, such as diet, exercise, interpersonal interaction, and sleep patterns. Many such behaviors have already been established as important influences on lipid concentrations in the circulation.

There is a strong public health focus on reducing blood cholesterol levels. Low cholesterol, either induced or naturally occurring, can have complex influences on psychosocial factors, and particularly mood.

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and Diane Bonfiglio

See also ANXIETY, HEART DISEASE, AND MORTALITY; HEART DISEASE: ANGER, DEPRESSION, AND ANXIETY; NATIONAL CHOLESTEROL EDUCATIONAL PROGRAM (NCEP)

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## LONELINESS AND HEALTH

Loneliness has been defined as the unpleasant experience that occurs when a person's network of social relationships is deficient in some important way, either quantitatively or qualitatively. Loneliness can be mild and fleeting but it can also be a persisting, distressing experience. Robert Weiss has identified two main types of loneliness: social loneliness stemming from the absence of an adequate social network, and emotional loneliness stemming from the absence of emotional attachments provided by intimate relationships. The proportion of people who acknowledge loneliness varies as a function of various factors

including the exact wording of the question posed (the nature of the loneliness described, the time span involved, etc.). Nonetheless, loneliness is clearly a widespread phenomenon. In one benchmark national survey of U.S. residents, 26% said they had felt “very lonely or remote from other people” in the past few weeks. Among adults in 18 countries, U.S. participants ranked high (fourth) in the extent of their loneliness, with the Japanese and Italians being highest in loneliness and the Danes being lowest.

Sociologists dating back to Durkheim have seen social ties as the mortar of society, arguing that when people feel alienated and lonely society is prone to breaking down. Consistent with this view, among adolescents loneliness has been associated with running away from home and delinquent acts such as gambling, theft, and vandalism. Similarly, sex offenders have been found to be high in loneliness and a correlation exists between suicidal ideation and loneliness. Loneliness can be a costly, serious problem for individuals and for society as a whole.

## LONELINESS AND MENTAL HEALTH

Taking the American Psychiatric Association’s widely known *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* as a standard for mapping the terrain, there are numerous varieties of deficient mental health. These have been grouped into such categories of disorders as childhood, anxiety, mood, personality, psychosis, eating, substance abuse, and sleeping. A number of researchers have examined loneliness as a correlate of mental health (for earlier reviews, see Jones & Carver, 1991, and Ernst & Cacioppo, 1999). They have generated a reasonable-sized body of work on anxiety, mood, and personality but fewer investigations on other topics. In contrast to the extensive evidence developmental psychologists have gathered showing that children rejected by their peers are vulnerable to loneliness, researchers have done very few investigations on loneliness and childhood *DSM-IV* disorders per se. Some researchers have studied clinical populations, although undoubtedly a majority have administered paper-and-pencil measures to students or community residents. Thus, many of their findings apply more to mental health tendencies among members of the general public than to individuals with clinically diagnosed psychopathologies. In any case, numerous noteworthy correlations have been found.

## Anxiety and Mood

Several studies have shown that the more loneliness people report, the more likely they are to report anxiety. Complementing self-reports, trait lonely individuals have high mean levels of cortisol, a physiological indicator of anxiety. Loneliness has also been implicated in various more specific forms of anxiety. For instance, Frieda Fromm-Reichmann saw loneliness as having much in common with panic states. Empirical studies find loneliness coupled with social anxiety in both children and adults. Not only has loneliness been included as a facet of posttraumatic stress disorder (PTSD), but also, among Israeli soldiers exposed to the stress of the 1982 Lebanon war, loneliness was an antecedent of combat-related psychopathology 2 years later.

During the 1970s, investigators observed a considerable concordance between loneliness and depression, so much so that they questioned if the two are separate phenomena. The answer is yes in the sense that statistical analyses have shown them to be distinguishable; logical analysis indicates that depression can result from any number of events whereas loneliness is a response to interpersonal deficits, and their correlates differ to some extent. More recent work shows that a self-critical form of depression is more closely associated with loneliness than a helpless, dependent variety. Complementing their greater depression, lonely individuals also report more negative and fewer positive feelings in response to mood scales. Lonely individuals are not a happy bunch.

## Personality

In an early article published before World War II, Gregory Zilboorg portrayed the personalities of lonely individuals as manifesting narcissism, megalomania, and hostility. Clinical writing and some statistical evidence with clinical populations suggest that loneliness is common among adults with so-called borderline personalities. Such individuals have an unstable sense of self and unstable interpersonal relationships, are impulsive, have difficulty controlling their anger, and engage in “acting out behaviors.” Correlational research shows loneliness is associated with several other personality characteristics such as low self-esteem, shyness, self-consciousness, neuroticism, pessimism, specific forms of perfectionism, and insecure attachment.



### Psychoses

Loneliness is also a part of the experience of schizophrenics. In one study, older adult patients with residual-type schizophrenia mentioned that they felt their loneliness had increased over the course of their lives. In another study involving a small number of schizophrenics and control participants, schizophrenics were more lonely than controls. Interestingly, and seemingly at odds with discrepancy explanations of loneliness, the difference between actual and ideal social support was the same for both groups.

### Eating Disorders

Loneliness appears to feed into eating disorders, although it is probably associated with both over- and undereating. Studies support the conclusion that obese as well as underweight individuals are lonely. With respect to loneliness, researchers have examined two specific eating disorders, bulimia and restraint. Bulimics are binge eaters who then purge themselves of their food. Two forms of complementary evidence show loneliness to be a characteristic of bulimics: (a) Among a sample of college students those matching the criteria for bulimia nervosa were higher in loneliness relative to participants not suffering from bulimia, and (b) older bulimics remember being lonely in their childhoods. Restrained eaters are individuals who think a great deal about food, have concern over their weight, and tend to diet to control it. Restrained eaters are lonely in their dispositions, yet when they are put in a lonely mood, their food intake is increased.

### Substance Abuse

In half of the studies ( $N = 4$ ) we could identify, loneliness was a risk factor associated with drug abuse. Apropos of alcohol abuse, a review of the relevant literature concluded alcoholics feel more lonely than most other groups. Loneliness is probably more closely associated with drinking during times of despair and unhappiness than social drinking. In young adults, loneliness predicts problem drinking (e.g., getting intoxicated). Those in treatment for alcoholism also show greater loneliness and, among advanced abusers, those high in loneliness show a poorer prognosis.

### Sleep Disturbances

Loneliness and sleep disturbances are commonly mentioned features of bereavement. Do they also go together at other times in life? Yes, according to John Cacioppo and associates' recent research program in which people's sleep was monitored both in a laboratory and in their homes. Although lonely and non-lonely people spent about the same amount of time in bed, the lonely people slept a smaller proportion of that time. They took longer to get to sleep and woke up more often with the result being they were asleep less. Lonely people also complained of more sleepiness during the day. To the extent that sleep is a restorative behavior promoting longevity, sleep disturbances may be a pathway by which loneliness affects mortality independent of health behaviors such as not smoking.

## LONELINESS AND PHYSICAL HEALTH

Beginning with Berkman and Syme's (1979) classic Alameda County Study, research has consistently indicated that measures of social contact and number of interpersonal relationships are related to physical health. After controlling for other risk factors, Berkman and Syme found that mortality rates among individuals with the lowest level of social contact were 2 to 3 times higher than among individuals with the highest level of social contact over a 9-year period. Subsequent reviews of research on the relationship between social relationships and health indicated that higher levels of social integration were consistently associated with reductions in the mortality rate (see Seeman, 2000).

Given that loneliness reflects a lack of interpersonal relationships or low levels of social contact, these data suggest that loneliness should also be related to measures of physical health. A number of longitudinal studies have found that loneliness predicts subsequent mortality. One recent study, for example, indicated that reports of loneliness predicted both 30-day and 5-year survival among heart bypass patients. Related to this finding, two studies that examined cause of death found loneliness to be associated with higher rates of death due to heart disease.

Loneliness is also associated with a variety of measures of physical health status. A number of studies have found loneliness scores to be significantly correlated with self-report ratings of health (e.g., how is your health, how does your health compare to others), with correlations ranging from  $-.18$  to  $-.55$ . Loneliness

correlates significantly with number of physical symptoms and number of illnesses. A recent study by Rook and her colleagues also found that loneliness was related to evidence of heart problems as detected in a physical examination of a community sample (Sorkin, Rook, & Lu, 2002).

One possible reason for this loneliness-health relationship involves preventive health behaviors. Loneliness has been found to be related to a variety of health-related behaviors, such as exercise, nutrition, relaxation, and substance use. Lonely individuals are less likely to engage in preventive behaviors. For instance, a study of older Canadian males and females found that users of psychotropic drugs (e.g., antidepressants) were more likely to be lonely (40%) than non-drug users (16%). Loneliness has also been found to predict health service use, with lonely individuals reporting more doctor visits and more frequent visits to the hospital emergency room.

The above suggests that there should be detectable physiological effects of high levels of loneliness on the body. Research by Jan Kiecolt-Glaser and Ron Glaser at Ohio State University has documented one such physiological effect of loneliness. They found that loneliness predicted several indices of immunocompetence. Studies they conducted using medical students and psychiatric patients showed that loneliness was related to immune system functioning of participants (see Kennedy, Kiecolt-Glaser, & Glaser, 1988). Supporting these results, a cross-sectional study by other researchers found that loneliness was related to lower numbers of CD4 cells in HIV-infected men. However, a longitudinal study found that higher levels of loneliness at baseline were associated with a *slower* rate of decline in CD4 cells over a subsequent 3-year period in HIV-infected men.

### Causal Issues in Studying Loneliness and Health

A critical question in examining correlational relationships such as we have been reporting concerns the causal mechanisms involved: Does poor health lead to loneliness, or does loneliness produce poor health? Could they mutually influence one another? Perhaps there really is no direct causation, but rather one should think of third variables producing these correlations or mediating processes. For example, as discussed above, studies have consistently found that loneliness is related to depression, with correlations as high as .50 to .60. Studies have also found that measures

of depression are related to subsequent mortality, suggesting that the loneliness-mortality relationship may be mediated by depression. Similarly, measures of loneliness are typically found to be strongly negatively related to measures of social support. Given that social support has been found to predict mortality, immune system functioning, cardiovascular disease, and other indicators of psychophysiology, relationships between loneliness and other measures of physical health may reflect the influence of social support on both loneliness and physical health.

To address these issues, Russell and his colleagues examined the relationship between loneliness and mortality while controlling for the influence of measures of interpersonal relationships (including social support) and depression among the elderly. A structural equation modeling analysis was conducted examining the ability of measures of social contact (i.e., social network size, social support, club involvement, and church attendance), loneliness, morale (i.e., depression, anxiety, and life satisfaction), and physical health (i.e., functional status, illnesses, doctor visits, and medications) to predict subsequent 12-year mortality. Results indicated that loneliness predicted subsequent mortality net of measures of social support and depression, through the mediating effects of physical health status. Loneliness was found to mediate the effects of social support on physical health and mortality, whereas the measures of morale were unrelated to subsequent mortality. These results therefore suggest that loneliness is related to physical health and mortality net of the influence of either depression or social support.

### CONCLUSION

In sum, loneliness has been associated with a variety of manifestations of poor mental and physical health. Solitude may be a wellspring of creativity and personal growth. Yet the experience of loneliness is a gnawing, pathogenic discomfort.

Most lonely people would be happy to overcome their loneliness. Using their own strategies and natural processes of recovery, people by themselves often overcome loneliness that is precipitated by such life course events as going away to school or the death of a partner. A variety of approaches have been offered by professionals and even loneliness "businesses" (e.g., cruise companies) for helping people alleviate their loneliness. Professional strategies range from community-based interventions, such as helping

people gain control over some aspect of their lives, to psychoeducational approaches to social skills training to group or individual therapy. In general, treatment outcome research testifies that such interventions have beneficial effects in comparison to waiting-list or placebo control conditions. Preventive lessons can also be learned from the growing body of knowledge of how factors beyond the individual (e.g., culture, environmental design, social policies) contribute to loneliness. Existentialists may be correct that loneliness is an inherent part of the human condition. But there does not need to be as much of it; less alienating lifestyles and societies can be fostered.

—Daniel Perlman and  
Daniel W. Russell

See also SOCIAL INTEGRATION, SOCIAL NETWORKS, AND  
HEALTH; SUPPORT GROUPS AND HEALTH

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## LOW BIRTH WEIGHT: PSYCHOSOCIAL ASPECTS

The health of a society is often judged by the health and well-being of its mothers and infants. Social inequalities in health in the United States are reflected in a high incidence of low birth weight; a much higher rate than seen in other developed nations and not markedly affected by advances in medicine and technology. Low birth weight is a leading cause of infant mortality and morbidity. It also represents an enormous economic cost to society, both in short-term medical costs and long-term loss of human capital. Rates of low birth weight vary greatly among American populations of different race, economic status, and class; in particular, the disparity in low birth weight between African American and White populations is a striking and persistent public health problem.

Prevention of low birth weight requires an understanding of factors that cause both *fetal growth retardation* and *shortened gestation*. Well-known obstetrical risk factors for low birth weight include maternal cigarette use, alcohol use, low prepregnancy body weight, poor weight gain during pregnancy, vaginal tract infections, and multiple gestations. Unfortunately, randomized trials of smoking cessation programs, enhanced prenatal care, nutritional programs, and prophylactic treatment of women at high risk for infection have been disappointing.

It has long been recognized that maternal African American race, unmarried marital status, low education attainment, and impoverishment are major sociodemographic risk factors for infant low birth weight. The mechanisms underlying these associations are incompletely understood and appear independent of the medical risk factors listed above. The psychosocial context of pregnant women is associated with overall health and reproductive outcome. This context includes their individual vulnerabilities or resilience to psychosocial stressors, their family environments and social networks, and work and neighborhood contexts, as well as the broader context of contemporary American society.

## MATERNAL CONTEXT

*Psychosocial stress.* Current thinking places maternal stress as the key link between the social, psychological, and biological environments that determine pregnancy outcome. Women living in socioeconomic deprivation or who are socially or psychologically vulnerable experience more stress than resilient women or women living in more advantaged contexts. Both direct/biological (e.g., via hormonal or immunologic pathway) and indirect/behavioral (via risky health behavior) mechanisms linking stress to low birth weight have been posited. These pathways are not mutually exclusive, and interactions between stress, maternal behavior, and maternal physiology are active areas of current research.

Stress is a complex construct. In epidemiological studies, different aspects of maternal stress that have been associated with an increased risk of low birth weight include the experience of stressful life events before and during pregnancy, anxiety (both general and pregnancy specific), depression, perceived stress, work-related stress, and unplanned pregnancy. Results are fairly consistent across studies, with increased stress associated with both shorter gestation and fetal growth restriction. Chronic stress appears to be more relevant than acute stressful events. The interaction between the presence of stressors, maternal perceptions of stress, coping resources, and vulnerability/resilience is an area of active research.

*Social networks and social support.* During pregnancy, the social support that a woman receives from family and friends, colleagues, and neighbors moderates the impact of stressors and may act as a buffer against the risk of low birth weight. Methodological difficulties in studying the subtleties of social support are highlighted by ethnographic studies, which suggest that women do not always perceive extensive and active social networks as supportive in relation to their pregnancies. Nevertheless, evidence from several decades' worth of observational studies is strongest for a protective role of support from an intimate partner, rather than from other sources, and for emotional, rather than instrumental, support. Unmarried women have consistently been shown to have a higher risk of both fetal growth restriction and preterm delivery, which may be due in part to a lack of intimate support. There is also accumulating evidence that exposure to intimate-partner violence,

whether or not it results in physical harm, increases the risk of low birth weight.

Since the 1970s, several randomized trials of social support interventions have been conducted among high-risk women, variously defined as having a previous low birth weight infant, being in a high-stress situation, or having low social support. In most cases, nurses, midwives, or social workers delivered the social support interventions during repeated home visits throughout the pregnancy. As with studies of enhanced prenatal care and health behavior modifications, results have been consistently disappointing. It is likely that the quantity, frequency, and content of the interventions delivered in randomized trials are inadequate to overcome the long-term and pervasive lack of social support among women whose lack of support or isolation puts them at risk of low birth weight.

*Socioeconomic status and social class.* Low maternal socioeconomic status is a risk factor for infant low birth weight. However, the strength of the associations between socioeconomic status and low birth weight varies by the unit of analysis (i.e., maternal/paternal/family education, occupation, or income). Researchers often select the unit of analysis based on their hypothesized conceptual model. For example, if maternal health behaviors are considered to mediate the effects of social position on pregnancy outcomes, maternal education may be a more relevant factor than father's occupation. If resiliency to stressors is considered to be important, then family social class may modify this factor. Greater attention to the conceptualization of pathways leading to low birth weight is increasingly apparent in the epidemiological literature, but much remains to be learned about the role of social position in reproductive health.

Delineation of the etiologic role of psychosocial factors in reproductive health requires stratified analyses of race and socioeconomic status/social class. African American women with a college-level education have excess rates of very low birth weight and preterm delivery compared to college-educated White women. However, traditional socioeconomic variables, including maternal education level, do not fully capture the impact of race on socioeconomic status. On average, African Americans who attend college earn less than White high school dropouts, and female-headed African American and White households show differences in terms of income. Since

discrimination and African American disadvantage is so pervasive in the United States, researchers have been unable to fully control for socioeconomic status.

## SOCIAL CONTEXT

Multilevel statistical analyses of the effect of the social environment are the latest burgeoning of a long tradition of inquiry into the effects of the environment on maternal and child health. Important developments in multivariable statistical methods allow contemporary researchers to attempt to disentangle the effects of individual race and socioeconomic status from the effects of residential segregation, socioeconomic, and social class context.

*Race/ethnicity.* Although the incidence of low birth weight decreases for African Americans and Whites as the number of individual-level risk factors declines, the improvement is faster among Whites, resulting in a wider racial disparity in low birth weight rates in low-risk women. This has led some investigators to suggest that the smaller birth weights and shorter gestations are genetically determined in African Americans. However, the birth weight patterns of infants of African-born women are similar to those of infants of U.S.-born White women. Moreover, regardless of socioeconomic status, infants of African-born Black women have a reduced low birth weight rate compared to infants of comparable U.S.-born Black women. The increased risk of low birth weight among African American women is perpetuated across generations. As data inconsistent with a genetic hypothesis accumulate, social and psychophysiological hypotheses are advanced.

Mexican American infants of U.S.-born mothers have a greater risk of low birth weight rate than infants of Mexican born mothers. This differential persists independent of obstetrical and sociodemographic characteristics; this supports the hypothesis that psychosocial factors related to women's life-long minority status are detrimental to reproductive outcome.

*Racial discrimination.* Although racism is a deep-rooted and multilayered phenomenon in the United States, there is a paucity of published data on the relationship between women's exposure to racism and pregnancy outcome. Exposure to interpersonal racism is both an acute and chronic stressor for African Americans. An exploratory study found that among a

sample of low-income African Americans maternal perception of exposure to racial discrimination during pregnancy was a risk factor for very low birth weight.

*Residential segregation.* In the United States, the geographic separation of the races is a long-standing reality. Interestingly, the racial composition of communities in which women reside affects their pregnancy outcomes. In 1950, Yankauer conducted a study of residential segregation by race and infant mortality in New York City. He found that areas with high proportions of births to non-White mothers had high population density, unsanitary conditions, lack of recreational areas, high rents for poor housing, and high rates of infant mortality. In a more recent study, residence in a predominantly African American community was associated with a decreased risk of low birth weight among African American women independent of individual socioeconomic status. The limited available data suggest that residence in neighborhoods with recent fluctuations in racial composition is associated with an increased risk of preterm delivery for African American women. A woman's experiences with stress and social support may explain this phenomenon.

*Neighborhood context.* The economic/class structure and unequal distribution of resources in society also contributes to population variation in low birth weight. A study found that the proportion of low birth weight infants in different Chicago neighborhoods rose for African Americans and Whites as the census tract median family income fell regardless of maternal age, education, or marital status.

Poor neighborhoods are characterized by (a) a higher prevalence of hazards to healthy pregnancy (e.g., reduced availability of healthful foods, increased levels of crime); (b) fewer protective resources (e.g., accessible prenatal care clinics); and (c) increased tolerance of health-compromising behaviors (e.g., more tolerance of smoking during pregnancy). Neighborhood deprivation, measured by such variables as unemployment and median income, has been consistently associated with increased risk of low birth weight and, in studies presenting race-specific analyses, it is clear that these relationships are more pronounced for African American women than for White women.

Absolute levels of affluence or poverty may be less important for health than relative inequalities. Positive

income incongruity, defined as living in a more affluent neighborhood than expected, given a family's marital and educational status, was associated with a decreased risk of very low birth weight in a population-based study in Chicago.

Interactions between neighborhood-level and individual-level risk factors are likely to be important but have been addressed in few studies. One study reported numerous such interactions, including a greater increased risk of low birth weight among women with low education living in high-crime areas than among comparable women living in low-crime areas. More research is needed to clarify the relationships between the environments in which women live, their perceptions of these environments, and their resilience/vulnerability to environmental influences on reproductive health.

*Societal context.* The effect of changing politics, policies, and economic health at the state and national levels is likely to have profound effects on health, although these are generally difficult to document, due to long time lapses between triggering events and most health outcomes. An economic recession, with adverse effects on diet and physical activity at the population level, would not be mirrored by an increased incidence in cardiovascular disease until many years later. In contrast, pregnancy lasts a very short time. No studies in the United States have examined the impact of economic trends on pregnancy outcomes, but one interesting study, based on Scandinavian data, found an association between quarterly national unemployment levels and rates of very low birth weight over two decades.

Low birth weight is the major factor underlying the persistently poor international rating of the United States on infant mortality. An expanding literature highlights an important association between a woman's exposure to psychosocial stress during pregnancy and infant birth weight. Novel conceptual

models that take into account pregnant women's neighborhood and social contexts are needed to help us better understand the psychophysiological mechanisms underlying racial and ethnic group differences in infant birth weight.

—Kate E. Pickett and  
James W. Collins Jr.

See also SOCIOECONOMIC STATUS AND HEALTH

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## MEDICAL PSYCHOLOGY

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Medical psychology “is the application of psychological concepts and methods to medical problems” (Rachman, 1977, p. vii). In a broader sense, medical psychology refers to the health care, research, and educational linkages of the discipline of psychology with medicine in the understanding, treatment, and prevention of illness and the promotion of health. Initially, the linkage was focused on child development and mental health and, as psychology developed as a life science, expanded to the broader purview of physical health. Psychology’s unique contributions stemmed from the application of behavioral science modes of inquiry, methods of investigation and analysis, and reliance on empirical verification to matters of health and illness.

The expansion of medical psychology from a focus on mental health to physical health was facilitated by the recognition of the limitations of the biomedical model that incorporated assumptions of mind/body dualism. In contrast, the biopsychosocial model (Engel, 1977) recognized that biological, psychological, and social processes act together in health and illness and must be considered simultaneously in the etiology, diagnosis, treatment, and prevention of illness and the promotion and maintenance of health.

The emergence of the biopsychosocial model provided the foundation for the integration of behavioral science and biomedical science approaches to matters of health and illness and spawned the development of a new, interdisciplinary, field of behavioral medicine. Psychology’s contributions to this new field are

reflected in the emergence of two subareas within the discipline: health psychology and pediatric psychology. The emergence of new fields and subareas indicates that the interplay of psychology and medicine continues to be dynamic and synergistic.

Examples of major areas of research and health service include adaptation to illness such as coronary heart disease, sickle cell disease, and diabetes; adherence to medical regimens; stress management, pain management, and treatment of anxiety and depression, eating disorders, and sleep disorders; psychoneuroimmunology; promotion of health-enhancing lifestyle behaviors; and prevention of disease and injury.

—Robert Joseph Thompson Jr.

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## METABOLIC SYNDROME AND STRESS

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The metabolic syndrome is a constellation of cardiovascular risk factors that is common among adults in industrialized societies. The key risk factors are glucose intolerance, insulin resistance, raised fasting serum triglycerides, and raised blood pressure.

Localization of body fat in the abdomen and low-level inflammation are often present within the cluster of risk factors. An individual with the metabolic syndrome may well be in good health but is more likely than others to develop Type 2, or maturity onset, diabetes and to experience a heart attack. Furthermore, there are indications of a causal connection between metabolic syndrome and accelerated decline of cognitive function. The metabolic syndrome is reversible. Effective treatment and prevention of the metabolic syndrome has the potential to reduce the burden of several key degenerative diseases.

Some ethnic groups, including those of South Asian origin, are particularly at risk of diabetes and coronary heart disease and are primary targets for intervention. Socially disadvantaged individuals are a further at-risk group. Prevalence of the metabolic syndrome, and each of its lipid and nonlipid components, is linked with low social status, and parallels the step-wise and inverse social gradients in risks for diabetes and cardiovascular disease. One approach is to treat individual risk factors as they are identified, for example, raised blood sugar (hyperglycemia) with an insulin-sensitizing drug, high blood pressure with a beta-blocker. This would entail medicalization of a large proportion of the adult population. Another approach is to prevent, or at least reduce, the probability that the metabolic syndrome will develop. To do so requires an understanding of its causes.

Accumulating evidence suggests the metabolic syndrome is a key component of the *social biology* of health inequalities. The characteristic and common pattern of the metabolic disturbances involved amount to a homeostatic alteration. There appear to be common causes, which are psychosocial, cultural, and behavioral in nature. Several causes of the metabolic syndrome are linked with low social status, including physical inactivity and, putatively, chronic stress.

The metabolic syndrome is also known as the insulin resistance syndrome and Reaven's syndrome X, after Gerald Reaven's description of the risk factor complex in 1988.

## NATURE OF THE METABOLIC SYNDROME

The metabolic syndrome is not a disease, but it can be thought of as a disease precursor state. Presence of the syndrome increases the probability that diabetes and cardiovascular disease may develop (see below).

An individual is considered to have prevalent metabolic syndrome when a characteristic group of cardiovascular risk factors is detected. There is no universally accepted definition. The core features of the metabolic syndrome are disturbances of lipid and carbohydrate metabolism, and raised blood pressure. An abdominal distribution of fat, increased heart rate, and evidence of low-level inflammation are also signs of the syndrome.

Clinical and biochemical tests are needed to establish whether an individual has the metabolic syndrome. The clinical measurements are resting blood pressure and waist circumference (or the ratio of waist to hip circumference). A fasting venous blood sample serves to provide measures of serum triglycerides, HDL cholesterol, and glucose. A more sensitive measure of impaired glucose tolerance is obtained by carrying out a standard 75-g oral glucose tolerance test (OGTT). The plasma glucose level at 2 hours after drinking the glucose solution provides a measure of insulin-mediated glucose uptake. A high 2-hour glucose level (7.8-11.0 mmol/l [140-200 mg/dl] on the World Health Organization [WHO] definition) reflects a degree of glucose intolerance and insulin resistance that is intermediate to normal (< 7.8 mmol/l [140 mg/dl]) and diabetic levels (> 11.0 mmol/l [200 mg/dl]). Compared with a fasting glucose measurement, the OGTT requires more time and may not be practicable.

There are two approaches to defining the metabolic syndrome. Neither is rigid, but depends on risk scores: finding adverse levels among the group of risk factors, typically three or more of five. Cut points have been agreed on by the Third Adult Treatment Panel of the U.S. National Cholesterol Education Program to provide a low-cost diagnostic definition that does not include an OGTT (see Table 1). A similar definition was proposed by WHO in 1999.

Alternatively, population-based surveys and epidemiological studies use cut points based on the observed distribution of relevant risk factors. The metabolic syndrome has been defined, for example, on the basis that three or more of the following five variables are within the sex-specific adverse 20% (top quintile) group: serum triglycerides, HDL cholesterol (bottom quintile), 2-hour glucose, systolic blood pressure, and waist-hip ratio. Diabetics and those on hypotensive medication are assigned to the top glucose and blood pressure quintiles, respectively.



**Table 1** ATPIII Definition of Metabolic Syndrome (defined by the presence of three or more of the five risk factors)

Waist circumference	<i>men</i>	> 102 cm (40 in)
	<i>women</i>	> 88 cm (35 in)
Serum HDL cholesterol	<i>men</i>	< 40 mg/dl (1.0 mmol/l)
	<i>women</i>	< 50 mg/dl (1.3 mmol/l)
Serum triglycerides		≥ 150 mg/dl (1.7 mmol/l)
Blood pressure		≥ 130/ ≥ 85 mmHg
Fasting glucose		≥ 110 mg/dl (6.1 mmol/l)

NOTE: ATPIII = Third Adult Treatment Panel of the U.S. National Cholesterol Education Program.

Using the “quintile” definition, prevalence of the syndrome was 12% among healthy male and female office workers about 50 years old (Whitehall II Study, 1991-1993; Brunner et al., 1997).

Different ATPIII (Third Adult Treatment Panel of the U.S. National Cholesterol Education Program) cut points for men and women for waist circumference and HDL cholesterol are a reflection of the distinct distributions of these variables in the two sexes. Distributions of the relevant risk factors may also differ by ethnic group. Inclusion of 2-hour glucose among the five variables is a strength of the quintile definition of the metabolic syndrome since the OGTT is a dynamic test of glucose handling that constitutes a metabolic challenge.

A representative survey of American adults found, using the ATPIII definition, that prevalence of the metabolic syndrome was 24%. The survey (3rd National Health and Nutrition Examination Survey,  $N = 8,814$ ) was carried out in 1988-1994, and in the decade since the continuing rise in overweight and obesity in the United States suggests that prevalence of the syndrome is likely to have risen to an even higher level. Prevalence was 7% among 20- to 29-year-olds, rising to more than 40% among those over 60 years of age. Prevalence was similar in women and men. Mexican Americans had the highest prevalence (32%), compared with European and African American ethnic groups.

There is some debate about the clinical and epidemiological utility of the metabolic syndrome concept. The core risk factors are associated with one another (see Table 2) and cluster together in multivariate statistical analysis. The associations are moderately strong, with correlations of magnitude 0.2-0.5. Consequently, there may be considerable variation in the level of one risk factor given a particular level of

another. Since each component of the metabolic syndrome is a risk factor for cardiovascular disease, it is to be expected that individuals with the syndrome are at higher risk of disease than those without it. Validity of the syndrome concept thus depends in some researchers' views on the extent to which the whole is greater than the sum of the parts. This question has not yet been resolved, in part because consensus has not been reached about definition. The value of a concept is that it provides a unifying framework within which to understand the metabolic disturbances that precede diabetes and cardiovascular disease.

## METABOLIC SYNDROME AND DISEASE

The main component risk factors of the metabolic syndrome, namely, impaired glucose tolerance, insulin resistance, central obesity, and disturbances of lipoprotein metabolism characterized by raised serum triglycerides and low HDL cholesterol, are each associated with increased risk of coronary heart disease. These linkages have been demonstrated in a large number of epidemiological studies in Caucasian, South Asian, and Native North American populations.

The metabolic syndrome has been shown to predict coronary heart disease. The Botnia Study, for example, followed 3,606 Finnish and Swedish adults for 7 years and found that risk of the disease was considerably higher among those who had the metabolic syndrome at baseline, on the basis of the WHO definition, compared with those who did not. Cardiovascular mortality was 12.0% in participants with the syndrome, and 2.2% among those without it.

The metabolic syndrome is associated with increased probability of developing Type 2, or maturity

**Table 2** Correlation Coefficients for Metabolic Syndrome Variables

	<i>Body Mass Index</i>	<i>Waist-Hip Ratio</i>	<i>Triglycerides</i>	<i>HDL Cholesterol</i>	<i>LDL Cholesterol</i>	<i>2-Hour Insulin</i>
<b>Men</b>						
Body mass index						
Waist-hip ratio	0.65					
Triglycerides	0.37	0.41				
HDL cholesterol	-0.30	-0.30	-0.47			
LDL cholesterol	0.13	0.18	0.24	-0.10		
2-hour insulin <sup>a</sup>	0.29	0.31	0.28	-0.21	0.08	
2-hour glucose <sup>a</sup>	0.11	0.14	0.16	-0.12	0.03	0.52
<b>Women</b>						
Body mass index						
Waist-hip ratio	0.57					
Triglycerides	0.38	0.45				
HDL cholesterol	-0.35	-0.36	-0.42			
LDL cholesterol	0.21	0.25	0.39	-0.20		
2-hour insulin <sup>a</sup>	0.26	0.33	0.28	-0.20	0.14	
2-hour glucose <sup>a</sup>	0.14	0.16	0.17	-0.08	0.10	0.46

SOURCE: Data from Whitehall II Study, Phase 3 examination (1991-1993).

a. 2-hour blood sample from 75-g oral glucose tolerance test.

onset, diabetes. Although progression is not inevitable, impaired glucose tolerance is a major risk factor for diabetes. Obesity and insulin resistance are further key aspects of the linkage between metabolic syndrome and diabetes. In the Whitehall II Study, obese men and women (body mass index > 30 kg/m<sup>2</sup>) were at high risk of having metabolic syndrome compared to those with normal body weight (odds ratios 15.8 in men, 18.9 in women). In the Atherosclerosis Risk in Communities Study (ARIC), approximately one quarter of obese participants were insulin resistant, and the obese were many times more likely to develop Type 2 diabetes than those of normal weight. In some populations, including South Asians, central obesity, reflecting accumulation of body fat in and around the abdomen, is a more important explanatory factor for glucose intolerance than the overall degree of obesity. One possible explanation is that abdominal fat is more resistant to the action of insulin than adipose tissue at other anatomical sites.

Evidence is accumulating that individuals with the metabolic syndrome may be at particular risk of decline in cognitive ability, particularly memory. Younger as well as older Type 2 diabetics show impaired performance on tests of immediate and

delayed memory, and verbal fluency. Individuals with nondiabetic glucose intolerance, a characteristic of metabolic syndrome, display similar cognitive impairments. Insulin resistance in combination with raised blood pressure has also been linked with low scores on tests of mental arithmetic and verbal fluency.

Lipid disturbances are associated with Alzheimer's disease. The ε4 allele of the apolipoprotein E gene (APOE 4) is a risk factor for Alzheimer's dementia, as well as cardiovascular disease. APOE codes a protein involved in transport of lipids in the circulation and, by mechanisms not well understood, the apoE protein influences the rate of accumulation of amyloid plaques that are characteristic of Alzheimer's disease. Although trial data are lacking, retrospective studies show that the cholesterol-lowering statin drugs may offer some protection from the disease. This is further evidence for the role of lipids, and potentially metabolic syndrome, in the development of Alzheimer's disease, since the statins raise HDL cholesterol levels. In summary, the core features of the metabolic syndrome are each separately linked with risk of accelerated decline in cognitive ability, and if present simultaneously in the same individual they may exert synergistic effects.

## METABOLIC SYNDROME AND SOCIAL INEQUALITIES IN HEALTH

The metabolic syndrome is a social phenomenon. Characteristically, its prevalence is highest in the lowest social stratum, declines in steps across the middle classes, and is lowest in the highest stratum. This inverse and stepwise social gradient can be seen as a reflection of the differing patterns of environment and experience encountered at different levels of the social hierarchy. With this perspective, the metabolic syndrome appears to be the product of the interplay between biological endowment and social circumstances. These complex effects provide some insight to the mechanisms accounting for the social patterns of chronic disease in urban populations.

The Whitehall studies, among other epidemiological studies, have shown that socioeconomic position is a powerful predictor of premature coronary heart disease. In the Whitehall cohorts, occupational status (Civil Service employment grade) is a better predictor of disease than the combination of smoking, serum cholesterol, and blood pressure, the classic risk factors. These observations point to the fact that social and economic organization is an important determinant of population health. The Whitehall II Study further shows that social differences in mean serum cholesterol and blood pressure are small, and explain very little of the social gradient in coronary heart disease, while smoking can account at most for one third of it.

The metabolic syndrome appears to be the biological mechanism responsible for translating social position into cardiovascular risk. In the Whitehall II cohort, each of the components of the syndrome, with the exception of systolic blood pressure, exhibits an inverse gradient with occupational status. The probability of being in the lowest (adverse) 20% of the distribution of HDL cholesterol levels is two- to threefold greater in the office-support grade than in the senior administrative grade (odds ratio [95% confidence interval] 1.93 [1.5-2.5] in men, 3.00 [2.0-4.5] in women, test for trend  $p < .001$  in both sexes). Similar gradients are observed for 2-hour glucose, serum triglycerides, plasma fibrinogen, and waist-hip ratio. Using the quintile definition (described above), the metabolic syndrome is strongly linked with lower occupational position (see Figure 1) (odds ratio for lowest vs. highest grade [95% confidence interval] 2.16 [1.6-2.9] in men, 2.75 [1.6-4.8] in women, test

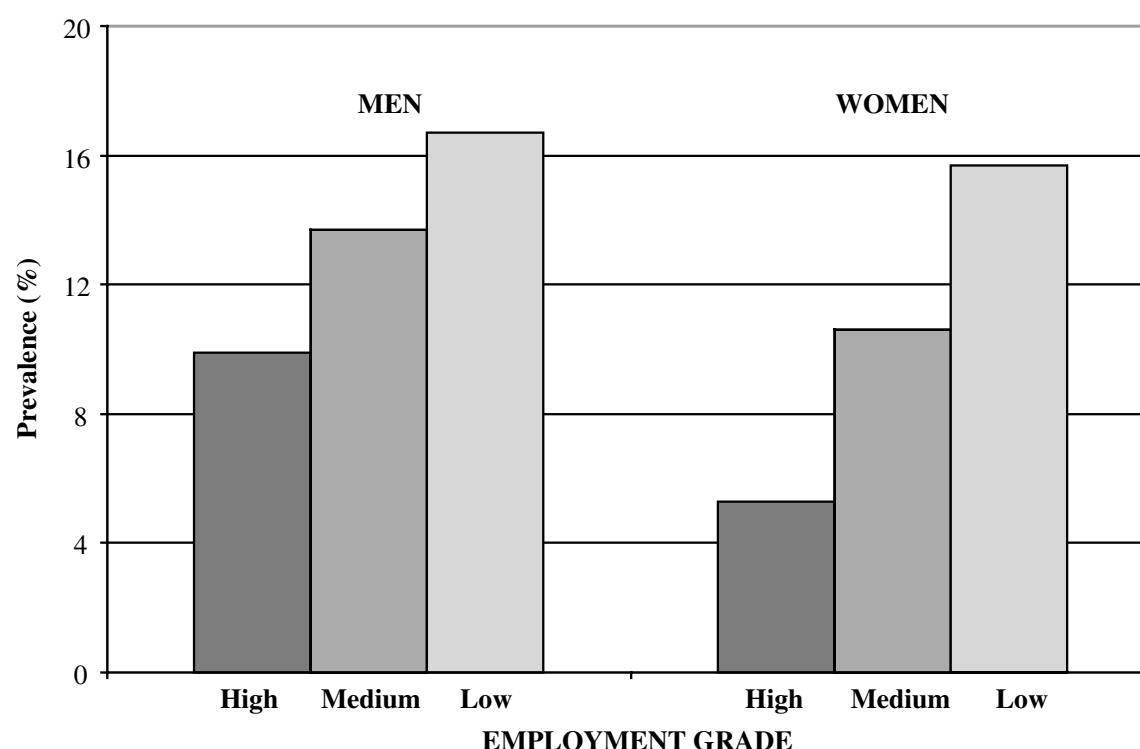
for trend  $p < .005$  in both sexes). These findings are replicated in other population-based surveys in Europe and North America, which show, for example, that central obesity is relatively common in lower social classes, and relatively rare in higher classes.

The metabolic syndrome is socially patterned. It also appears to be a powerful biological explanation for the inverse social gradient in coronary heart disease. This is evident in a prospective analysis of incident fatal and nonfatal coronary events in the Whitehall II Study. In multiple logistic regression analysis, metabolic syndrome variables measured at baseline account statistically for about half of social inequality in heart disease incidence. This is an important observation. The metabolic syndrome, in these men and women, is a better explanation for the inverse social gradient in coronary heart disease than is smoking.

## METABOLIC SYNDROME AND STRESS

Stress can be physical, mental, or emotional in nature. It implies some external pressure that places demands on the capacity to respond. If the individual rises to the occasion without going beyond usual limits, then balance and equanimity will quickly return. This, at a basic level, is success: the ability to survive and if possible to flourish despite the impositions of the environment. Success and stress are, however, not opposites. Instead, we can see that stress leads to two types of outcome. One is a return to previous stability, the other a transition, temporary or permanent, to some alternative state.

The metabolic syndrome is a particularly common "alternative state" today, but this was not the case in the past. In pre-industrial societies, metabolic syndrome and Type 2 diabetes were rare if not unknown. But under current conditions in Westernized societies, prevalence of the metabolic syndrome among 50-year-olds is 10% to 30%, and diabetes approximately half of that, depending on the population in question and the syndrome definition used. Given this vast and growing global burden, it is appropriate to suspect that certain features of modern life are stressful. At the same time, we should bear in mind that never in history has life expectancy been so high within the populations in question, largely as a result of material living standards rather than the health care we may be fortunate enough to receive.



**Figure 1** Prevalence of the Metabolic Syndrome by Civil Service Employment Grade (adjusted for age)

SOURCE: Whitehall II Study (Brunner et al., 1997).

Two biological pathways appear to be important to the emergence of the metabolic syndrome as a public health problem. Both can be seen as stress mechanisms arising from modern living conditions, though they are different in nature. The first is the consequence of our industrialized food supply together with the virtual elimination of need for physical activity. The second results from the mental and emotional distress of living in a hierarchical, complex, and competitive society, where the high status and economic success of the few bring fabulous rewards that will never be shared by the many.

An abundance of food and a low requirement for energy expenditure are defining characteristics of Westernized society. On the input side, it is possible to buy 70% of a woman's daily energy requirement (1900 calories) for \$3.60, as a hamburger meal with a large serving of fries and Coke. On the output side, vigorous physical activity off the sports field is almost unheard of, and even moderate activity is unnecessary. These are prime conditions for generating a population that is overweight if not obese. However, biology and arithmetic are not so simple. Considering that 1 gram of fat is equivalent to only some 10 calories, a

daily excess of energy intake over expenditure of as little as 1% (20 calories) would over a year convert to substantial weight gain. It is clear that there are homeostatic mechanisms to ensure this does not happen. Physiological control of appetite and diet-induced thermogenesis are able to regulate weight with exquisite sensitivity.

Yet the recent explosion of obesity indicates that weight regulation is not functioning well enough for 40% to 50% of the adult population. The explanation appears to lie partly in our food-saturated and sedentary environment, and partly in a widely inherited tendency to obesity. James Neel's thrifty genotype hypothesis proposes that Type 2 diabetes is the product of a genetic predisposition to store fat efficiently in times of plenty. Such a trait would have survival advantage during food scarcity and rarely lead to diabetes. In present conditions, when energy-dense food is abundant and prolonged physical activity unnecessary, this trait is often likely to lead, first, to obesity, second, to insulin resistance, and then to impaired glucose tolerance. Chronic physical inactivity adds to this process not only because energy expenditure and resting metabolic rate are low. Lower muscle mass and muscle blood flow are linked

with insulin resistance, glucose intolerance, and low HDL cholesterol levels. A combination of aerobic endurance training and circuit-type resistance training appears to be an optimal program for reversing the disturbances characteristic of the metabolic syndrome, as well as for preventing its development.

The second mechanism is firmly located at the heart of modern life. Basic material needs are not the preoccupations they once were, but unemployment, low autonomy at work, excessive overtime, social isolation, and loss of a sense of control in the frenzy of aspiration appear to be bad for physical as well as psychological health. There is biological plausibility and growing evidence that chronic psychosocial stress may contribute to risk of metabolic syndrome, and later to Type 2 diabetes and coronary heart disease.

Robert Sapolsky and others have made a compelling case for the damaging effects of modern societies, particularly for those near the bottom of the socioeconomic scale. The key argument is an evolutionary one. Humans are adapted to respond to the challenge of external threats with an autonomic reaction, followed by a rise in cortisol secretion. This defense, or fight-or-flight, mechanism is useful in an emergency, but if repeatedly activated, may be maladaptive in the urban environment. The price of this maladaptation is the metabolic syndrome.

The launch of the defense reaction is familiar to us. Rapid release of epinephrine from the adrenal medulla and norepinephrine from sympathetic nerve endings produces cognitive arousal, sensory vigilance, bronchodilation, increased heart rate, raised blood pressure, and energy mobilization. The effect of this neuroendocrine response is to prepare for physical exertion, not for a call to credit control. The second neuroendocrine pathway, the hypothalamic-pituitary-adrenal (HPA) axis, comes into action more slowly, and is more sustained. This component of the stress response involves release of cortisol from the adrenal cortex. Cortisol serves to protect the individual from the potentially malign effects of inflammation and infection, and the accompanying host response. But it also antagonizes the effects of insulin, acting to mobilize energy reserves by raising blood glucose and promoting fatty acid release from adipose tissue. In a physically inactive situation, these superfluous energy substrates increase hepatic lipoprotein output, and the circulating triglyceride level.

Repeated autonomic and HPA stimulation, particularly in combination with a sedentary lifestyle, is therefore a plausible cause of metabolic syndrome.

During the past 20 years, longitudinal epidemiological studies have been set up to test the psychosocial hypothesis of coronary heart disease causation. Evidence is accumulating that low control at work, lack of social support, and depressed mood predict incident disease. Whether chronic psychosocial stress is an important cause of atherosclerosis, exerting its effects independent of behavioral factors such as diet and smoking, remains at present uncertain.

A component question is whether there are psychosocial causes of the metabolic syndrome. If this were demonstrated, there would be a direct biological mechanism to link stress with heart disease. A recent addition to the evidence is a case control study comparing metabolic syndrome cases with healthy controls. The study tested the hypothesis that disturbances in neuroendocrine function and cardiac autonomic activity contribute to development of the metabolic syndrome. Urinary outputs of cortisol and norepinephrine metabolites were measured over 24 hours. Cardiac autonomic activity was obtained from analysis of digitized electrocardiogram recordings. Cortisol metabolite and normetanephrine (3-methoxynorepinephrine) outputs were higher among cases than controls (0.49, 0.45 standard deviations [*SD*], respectively, both  $p < .05$ ). Heart rate was higher (72.3 vs. 64.5 beats/min,  $p = .002$ ) and heart rate variability was lower ( $-0.72$  *SD*,  $p < .001$ ) among cases. Multiple regression models showed that psychosocial factors (employment grade, self-reports of household assets, and job strain) accounted for 37% of the link between metabolic syndrome and normetanephrine output, and about 15% for cardiac autonomic activity. Health-related behaviors (smoking, diet indicators, physical activity, and alcohol consumption) accounted for 5% to 18% of neuroendocrine differences.

This study simultaneously linked the two major neuroendocrine stress axes and cardiac autonomic activity with the metabolic syndrome. Output of cortisol and norepinephrine metabolites was higher among cases than controls. Heart rate variability was lower, indicating sympathetic predominance and reduced vagal tone. Psychosocial factors and health-related behaviors each explained a part of the neuroendocrine disturbances that accompany the syndrome. Follow-up of individuals who had metabolic syndrome at baseline but not 5 years later showed that the neuroendocrine changes are partially reversible. This is the first evidence that chronic psychosocial stress contributes to development of metabolic syndrome,

although confirmatory prospective studies are required.

—Eric Brunner

See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
CARDIOVASCULAR REACTIVITY; STRESS: BIOLOGICAL  
ASPECTS

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## MINNESOTA MULTIPHASIC PERSONALITY INVENTORY (MMPI/MMPI-2)

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The Minnesota Multiphasic Personality Inventory (MMPI/MMPI-2) is a 567-item true-false questionnaire that is currently the most widely used objective measure of psychopathology and personality in the world. Psychologist S. R. Hathaway and psychiatrist J. C. McKinley developed the original MMPI in the late 1930s at the University of Minnesota. The MMPI was constructed through a series of empirical studies that statistically identified items distinguishing groups of patients with various psychiatric conditions from a normative group (visitors to the University of Minnesota Hospital). This process yielded a set of 10 dimensional scales that measured facets of emotional disturbance such as somatic preoccupation, depression, antisocial attitudes and behaviors, persecutory ideation, anxiety, and thought disorder as well as personality traits such as introversion and gregariousness. Scores that fell 2 (1.5 for the MMPI-2) standard deviations above the mean of the normative group were designated clinically significant. Importantly, scales that identified general defensiveness and minimization or exaggeration of self-reported symptoms were also included in the instrument. The inclusion of validity scales was an innovation that remains a significant asset for the clinician when using the MMPI-2 because the accuracy of the patient's self-report can be reliably determined before inferences are made regarding the presence or absence of symptoms. Over the years, supplementary and focused content scales were derived from the MMPI item pool to assess clinically relevant phenomena such as posttraumatic stress disorder and substance abuse.

In 1989, a restandardization procedure that included the development of a diverse and nationally representative normative sample yielded the MMPI-2. The new normative sample consisted of 2,600 men and women from throughout the United States and encompassed individuals from a wide range of socioeconomic, educational, and ethnic backgrounds. The MMPI-2 retained the original validity and clinical scales; however, outdated items were eliminated and items were revised to improve item comprehension. Furthermore, new item content was added to reflect contemporary clinical issues such as drug and alcohol abuse, suicidal ideation, and Type A behavior. Moreover, new validity and content scales were added to address contemporary clinical and interpretive concerns.

The MMPI-2 is used in a wide variety of settings to screen for psychopathology and aid in clinical decision making. The broad acceptance of the MMPI-2 is a result of the objective nature of the instrument and the extensive 60-year history of accumulated research supporting the validity of the MMPI/MMPI-2 in clinical judgment and decision making. Beyond the use of the MMPI-2 in employment screening, forensic evaluation, and outpatient and inpatient psychiatric settings, the MMPI-2 is widely used in medical settings. Scales associated with somatic preoccupation, Scale 1 (Hs), the potential to react to stress by developing physical symptoms, Scale 3 (Hy), and the report of a wide range of somatic symptoms and a preoccupation with bodily functions (Health Concerns) have been extensively studied in medical settings. These studies have established the predictive validity of the MMPI/MMPI-2 in medical and behavioral health settings. For example, individual attributes tapped by the items on the MMPI-2 Scale 3 (Hysteria) are associated with becoming disabled as a result of a work-related injury and remaining disabled after treatment. Importantly, the MMPI/MMPI-2 was administered prior to the injury, suggesting that the instrument was able to identify personal attributes and psychological factors that hindered recovery from injury and led to extended disability.

Within medical and behavioral health settings, the MMPI-2 is frequently used to screen for psychopathology and fitness to undergo medical treatments or procedures such as organ transplantation. The instrument is also used to determine the capacity to benefit from intensive treatment regimens or actively participate in physical rehabilitative programs.

As part of a comprehensive evaluation, the MMPI-2 can provide valuable information regarding the emotional response to an acute or chronic medical condition and provide information regarding substance abuse issues in patients being treated with potentially addictive analgesics.

The MMPI-2 can indicate how typical an individual's psychological response to a particular injury or medical condition is and also quantify this response relative to other patients. For example, chronic pain patients generally produce three MMPI-2 profile clusters. These three clusters include groups marked by elevations on both the 1 and 3 scales, a group marked by multiple clinical scale elevations associated with significant distress and maladjustment, as well as a group with all the MMPI-2 clinical scales falling within the normal range. Within the context of treatment for chronic pain, the MMPI-2 can identify how the person is presenting himself or herself for treatment, describe the emotional response to the pain, and determine how common such response is relative to others experiencing chronic pain. Chronic pain patients who produce profiles that fall within normal limits are coping with their pain with less distress and emotional sequelae than those who produce elevations on multiple MMPI-2 clinical scales. Given this information, interventions can be tailored to address the differences in emotional response to the chronic pain syndrome.

The use of the MMPI-2 in behavioral health settings provides the clinician with objective and clinically relevant information regarding the psychological response of patients to their medical condition. Originally, the MMPI was thought to be useful in identifying individuals whose physical complaints were "functional" or nonorganic in nature. On the contrary, rather than determining the nature of self-reported physical complaints, the MMPI-2 provides useful information regarding the psychological context within which the physical complaints occur and the emotional response to the medical condition. Specifically, the MMPI-2 serves as an objective measure of how well patients are emotionally coping with their condition, their psychological approach to medical interventions or procedures, and the relative degree of emotional turmoil and distress experienced within the context of their condition.

—Paul A. Arbisi and James N. Butcher

## MOTIVATIONAL INTERVIEWING

Motivational interviewing (MI) is a client-oriented counseling method that was developed originally by William Miller and Stephen Rollnick for the treatment of people with addictive behavior such as alcohol use. It motivates people by helping them to recognize the difference between their current behavior and future personal goals and values (Miller & Rollnick, 2002). MI helps people explore the difficulties they have with their current behavior and make commitment to change.

### PRINCIPLES AND ELEMENTS OF MOTIVATIONAL INTERVIEWING

Some of the principles of MI include expressing empathy or understanding of a client's behavior, avoiding argumentation with the client, and supporting a client's self-confidence toward changing the current behavior. Key elements used in MI are reflective listening and eliciting self-motivational statements. Through reflective listening, clients are allowed to express their views of the problem, even if the provider does not agree with the client. This way, the provider appreciates a true understanding of the client's perspective and experience. MI helps clients to develop and make statements that will encourage them to change their current problem behavior. Such self-motivational statements help clients understand and see how their problem behavior affects their future personal goals and values (Miller & Rollnick, 2002). Other elements employed in MI include giving clients feedback on their behavior, giving advice only when solicited, putting the responsibility for change on the client, and providing clients with a menu of options for behavior change.

### APPLICATION OF MOTIVATIONAL INTERVIEWING IN HEALTH BEHAVIOR

The broadest application of MI is in the area of addictive behaviors. It is only recently that MI is beginning to be used in improving treatment adherence and outcomes in other areas of health behavior change such as obesity and diabetes, HIV risk factor modification, dietary adherence, fruit and vegetable intake, mammography screening, eating disorders, smoking cessation, and physical activity. There are

currently several randomized controlled trials funded by the National Institutes of Health (NIH) testing the effectiveness of MI in improving medication adherence in hypertensive and HIV patients. As part of the Behavioral Change Consortium at the NIH, there are at least 15 current NIH-funded studies where MI is being tested as a primary or adjunct intervention for health behavior change, with different types of counselors and delivery modalities (see <http://www1.od.nih.gov/behaviorchange/>).

—Gbenga Ogedegbe

See also ALCOHOL ABUSE AND DEPENDENCE: TREATMENT; HEALTH PROMOTION AND DISEASE PREVENTION

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## MULTILEVEL METHODS, THEORY, AND ANALYSIS

The term *multilevel* relates to the levels of analysis in public health research, which usually, but not always, consist of individuals (at lower level) who are nested within spatial units (at higher levels). Multilevel methods, meanwhile, consist of quantitative procedures that are pertinent when (a) the observations that are being analyzed are correlated; (b) the causal processes are thought to operate at more than one level; and/or (c) the research interest is especially in describing the variability and heterogeneity in the population, rather than average values.

Multilevel methods are specifically geared toward the statistical analysis of data that have a *nested* structure. The nesting, typically, but not always, is hierarchical.



For instance, a two-level structure would have many level-1 units nested within a smaller number of level-2 units. For instance, in educational research—the field that provided the impetus for multilevel methods—level-1 usually consists of pupils who are nested within schools at level-2. Such structures arise routinely in health and social sciences, such that level-1 and level-2 units could be workers in organizations, patients in hospitals, or individuals in neighborhoods, respectively.

## MULTILEVEL DESIGNS

The existence of nested data structures is neither random nor ignorable; for instance, individuals differ but so do the neighborhoods. Differences among neighborhoods could either be directly due to the differences among individuals who live in them, or groupings based on neighborhoods may arise for reasons less strongly associated with the characteristics of the individuals who live in them. Regardless, once such groupings are established, even if their establishment is random, they will tend to become differentiated. This would imply that the group (e.g., neighborhoods) and its members (e.g., individual residents) can exert influence on each other suggesting different sources of variation (e.g., individual-induced and neighborhood-induced) in the outcome of interest and thus compelling analysts to consider covariates at the individual *and* at the neighborhood levels. Ignoring this multilevel structure of variations not simply risks overlooking the importance of neighborhood effects but has implications for statistical validity.

To put this in perspective, in an influential study of progress among primary school children, Bennett (1976), using single-level multiple regression analysis, claimed that children exposed to a “formal” style of teaching exhibited more progress than those who were not. The analysis while recognizing individual children as units of analysis ignored their grouping into teachers/classes. In what was the first important example of multilevel analysis using social science data, Aitkin, Anderson, and Hinde (1981) reanalyzed the data and demonstrated that when the analysis accounted properly for the grouping of children (at lower level) into teachers/classes (at higher levels), the progress of formally taught children could not be shown to significantly differ from the others.

What was occurring here was that children within any one class/with one teacher, because they were

taught together, tended to be similar in their performance thereby providing much less information than would have been the case if the same number of children had been taught separately. More formally, the individual samples (e.g., children) were *correlated* or *clustered*. Such clustered samples do not contain as much information as simple random samples of similar size. As was shown by Aitkin et al. (1981), ignoring this autocorrelation and clustering results in increased risk of finding differences and relationships where none exist.

Clustered data also arise as a result of sampling strategies. For instance, while planning large-scale survey data collection, for reasons of cost and efficiency, it is usual to adopt a multistage sampling design. A national population survey, for example, might involve a three-stage design, with regions sampled first, then neighborhoods, and then individuals. A design of this kind generates a three-level hierarchically clustered structure of individuals at level-1 nested within neighborhoods at level-2, which in turn are nested in regions at level-3. Individuals living in the same neighborhood can be expected to be more alike than they would be if the sample were truly random. Similar correlation can be expected for neighborhoods within a region.

Much documentation exists on measuring this “design effect” and correcting for it. Indeed, clustered designs (e.g., individuals at level-1 nested in neighborhoods at level-2 nested in regions at level-3) are often a nuisance in traditional analysis. However, individuals, neighborhoods, and regions can be seen as distinct structures that exist in the population that should be measured and modeled.

## A Typology of Multilevel Data Structures

The idea of multilevel structure can be recast, with great advantage, to address a range of circumstances where one may anticipate clustering. Health outcomes and behaviors as well as their causal mechanisms are rarely stable and invariant over time, producing data structures that involve repeated measures, which can be considered a special case of multilevel clustered data structures. Consider the *repeated cross-sectional design* that can be structured in multilevel terms with neighborhoods at level-3; year/time at level-2 and individuals at level-1. In this example, level-2 represents repeated measurements on the neighborhoods (level-3) over time. Such a structure can be used to

investigate what sorts of individuals and what sorts of neighborhoods have changed with respect to health outcomes. Alternatively, there is the classic *repeated measure or panel design* in which the level-1 is the measurement occasion, level-2 is the individual, and level-3 is the neighborhood. This time, the individuals are repeatedly measured at different time intervals so that it becomes possible to model changing individual behaviors within a contextual setting of, say, neighborhoods.

When different responses/outcomes are correlated, this lends itself to a *multivariate multilevel data structure* in which level-1 are sets of response variables measured on individuals at level-2 nested in neighborhoods at level-3. The *multivariate responses* could be, for instance, different aspects of health behavior (e.g., smoking and drinking). In addition, such responses could be a mixture of “quality” (do you smoke/do you drink) and “quantity” (how many/how much) producing *mixed multivariate responses*. The substantive benefit of this approach is that it is possible to assess whether different types of behavior and whether the qualitative and quantitative aspects of each behavior are related to individual characteristics in the same or different ways. In addition, we can also ascertain whether neighborhoods that are high for one behavior are also high for another and whether neighborhoods with high prevalence of smoking, for instance, are also high in terms of the number of cigarettes smoked.

While the previous examples are strictly hierarchical, in that all level-1 units that form a level-2 grouping are always in the same group at any higher level, data structures could be nonhierarchical. For example, a model of health behavior (e.g., smoking) could be formulated with individuals at level-1 and both residential neighborhoods *and* workplaces at level-2 not nested but crossed, also called *cross-classified structures*. Individuals are then seen as occupying more than one set of contexts, each of which may have an important influence.

A related structure occurs where for a single level-2 classification (e.g., neighborhoods), level-1 units (e.g., individuals) may belong to more than one level-2 unit, also referred to as *multiple membership designs*. The individual can be considered to belong simultaneously to several neighborhoods with the contributions of each neighborhood being weighted in relation to its distance (if the interest is spatial) from the individual.

## MULTILEVEL ANALYSIS

Three constitutive components of multilevel analysis are identified and discussed with examples from public health research.

### Evaluating Sources of Variation: Compositional and/or Contextual

A fundamental application of multilevel methods is disentangling the different sources of variations in the outcome. Evidence for variations in poor health, for instance, between different contexts can be due to factors that are intrinsic to, and are measured at, the contextual level. In other words, the variation is due to what can be described as *contextual, area, or ecological effects*. Alternatively, variations between places may be *compositional*; that is, certain types of people who are more likely to be in poor health due to their individual characteristics happen to be clustered in certain places. The issue, therefore, is not whether variations between different places exist (they usually do), but what is the primary source of these variations. Put simply, are there significant contextual differences in health between settings (such as neighborhoods), after taking into account the individual compositional characteristic of the neighborhood?

The notions of contextual and compositional sources of variation have general relevance and they are applicable whether the context is administrative (e.g., political boundaries), temporal (e.g., different time periods), or institutional (e.g., schools or hospitals).

### Describing Contextual Heterogeneity

Contextual differences may be complex such that it may not be the same for all types of people. Describing such *contextual heterogeneity* is another aspect of multilevel analysis and can have two interpretative dimensions. First, there may be a *different amount* of neighborhood variation, such that, for example, for high-social-class individuals it may not matter in which neighborhoods they live (thus a smaller between-neighborhood variation) but it matters a great deal for the low social class and as such shows a large between-neighborhood variation. Second, there may be a *differential ordering*: Neighborhoods that are high for one group are low for the other and vice versa. Stated simply, the multilevel analytical

question is, are the contextual neighborhood differences in poor health, after taking into account the individual composition of the neighborhood, different for different types of population groups?

### Characterizing and Explaining the Contextual Variations

Contextual differences, in addition to people's characteristics, may also be influenced by the different characteristics of neighborhoods. Stated differently, individual differences may interact with context and ascertaining the relative importance of individual and neighborhood covariates is another key aspect of a multilevel analysis. For example, over and above social class (individual characteristic), health may depend on the poverty levels of the neighborhoods (neighborhood characteristic). The contextual effect of poverty can either be the same for both the high and low social class suggesting that while neighborhood poverty explains the prevalence of poor health, it does not influence the social class inequalities in health. On the other hand, the contextual effects of poverty may be different for different groups, such that neighborhood poverty adversely affects the low social class but does the opposite for the high social class. Importantly, neighborhoods at the lowest level of poverty are also areas with the least health disparities as compared with areas at the highest level of poverty.

Thus, neighborhood-level poverty is not only related to average health achievements but also shapes social inequalities in health. The analytical question of interest is, are the effects of neighborhood-level socioeconomic characteristics on health different for different types of people?

## MULTILEVEL STATISTICAL MODELS

Like all statistical regression equations, multilevel models have the same underlying function, which can be expressed as

$$\text{Response} = \text{Fixed/Average Parameters} + (\text{Random/Variance Parameters}).$$

While in a conventional regression model the random part of the model is usually restricted to a single term (that are called error terms or residuals), in the *multilevel regression model* the additional focus is on

expanding the random part of a statistical model. A simple two-level model with a response, a normally distributed measure of poor health, and a single continuous individual (compositional) predictor, age, centered about its mean, for a random sample of individuals at level-1 who are nested within, and drawn from, a group of neighborhoods at level-2 is considered. Since a particular individual is assumed to belong to one and only one neighborhood, and assuming that two individuals from the same neighborhood are correlated, thereby producing a hierarchic nested structure, they are also referred to as *hierarchical models*.

### Variance Components or Random Intercepts Model

Multilevel models operate by developing models at each level of analysis and combine them to form a full multilevel model. In the illustration considered here, models would have to be specified at two levels, level-1 and level-2. The model at level-1 can be formally expressed as

$$y_{ij} = \beta_{0j} + \beta_1 x_{1ij} + e_{0ij}, \quad (1)$$

where  $y_{ij}$  is the measure of poor health for the  $i^{\text{th}}$  individual in the  $j^{\text{th}}$  neighborhood. The term  $\beta_{0j}$  (associated with a constant) is the average poor health for the  $j^{\text{th}}$  neighborhood;  $\beta_1$  is the fixed marginal effect of age ( $x_{1ij}$ ) on poor health. The individual or the level-1 residual term,  $e_{0ij}$ , as in the ordinary regression case, typically, is assumed to have a normal distribution with a 0 mean and a variance,  $\sigma_{e0}^2$ .

Within the framework of multilevel models, the coefficients at level-1 become outcome variables at level-2. Thus, the model at level-2 can be expressed as

$$\beta_{0j} = \beta_0 + u_{0j}. \quad (2)$$

Stated verbally, the average poor health for the  $j^{\text{th}}$  neighborhood is decomposed into  $\beta_0$  (the "grand" average for poor health across all neighborhoods) and  $u_{0j}$ , which is the effect specific to the  $j^{\text{th}}$  neighborhood, that is, the differential contribution (positive or negative) that this neighborhood makes to the prediction of the individual poor health.

The new neighborhood-specific term  $u_{0j}$  can be treated in one of the two ways. One procedure for incorporating the differential contribution of neighborhoods

into a model is to fit a different regression line for each place. In some circumstances, for instance, when there are fewer higher-level units (e.g., neighborhoods) and a moderately large number of individuals in each, this may be efficient. It may also be appropriate if the interest is in making inferences about just those neighborhoods. However, if some of the neighborhoods have very few individuals, and if our interest is to make inferences about the neighborhood in general, fitting a separate model for each neighborhood may not be a viable strategy.

On the other hand, if neighborhoods are treated as a (random) sample from a population of neighborhoods and the interest is in making inferences about the variation between neighborhoods in general, that would constitute a *multilevel statistical approach*. Just as individuals are treated as a sample from a population of individuals and where a sample is used to make inferences about the population rather than about each individual, the neighborhoods are instruments for making inferences about the relevant population of neighborhoods. Adopting this approach provides a model with two random variables, one at each level of the data structure, and it is this feature that makes it a *multilevel statistical model*. Consequently,  $u_{0j}$  can be treated in a manner similar to individual-level residuals.

Substituting the level-2 model (Equation 2) into level-1 model (Equation 1) and grouping them into fixed and random part components (the latter shown in brackets) yields the combined model, also referred to as *random-intercepts* or *variance components* model:

$$y_{ij} = \beta_0 + \beta_1 x_{1ij} + (u_{0j} + e_{0ij}). \quad (3)$$

Assuming independence of the residual terms at level-1 and level-2,  $e_{0ij}$  and  $u_{0j}$ , respectively, the variance at level-2,  $\sigma_{u0}^2$ , measures the neighborhood differences after accounting for the compositional effect of age. It is in this way that the multilevel model disentangles the compositional effects (e.g., individual age) from the contextual differences between neighborhoods. Stated differently, multilevel models allow *variance partitioning* by different levels and the proportion of variance attributable to the level of neighborhood is achieved by dividing the level-2 variance by the total variance, which is given in Equation 4. Such statistics, also known as *intra-class correlation*, or *intra-unit correlation*, or *variance partitioning*

*coefficient*, are of great interest since they provide direct clues to the level at which an action lies or does not lie.

$$\sigma_{u0}^2 / \sigma_{u0}^2 + \sigma_{e0}^2. \quad (4)$$

### Random Coefficients or Random Slopes Models

The level-1 model described in Equation 1 can be extended to describe the *contextual heterogeneity* in poor health/age relationship. This can be achieved by allowing the fixed effect of age to randomly vary across neighborhoods in the following manner:

$$y_{ij} = \beta_{0j} + (\beta_{1j} x_{1ij} + e_{0ij}). \quad (5)$$

At level-2, there will now be two models:

$$\beta_{0j} = \beta_0 + u_{0j} \quad (6)$$

$$\beta_{1j} = \beta_1 + u_{1j}. \quad (7)$$

Multilevel models specify the different intercepts and slopes for each context as coming from a distribution at a higher level. Substituting the macro models in Equations 6 and 7 into the micro model in Equation 5 gives the following:

$$y_{ij} = \beta_0 + \beta_1 x_{1ij} + (u_{0j} + u_{1j} x_{1ij} + e_{0ij}). \quad (8)$$

The key change is that the age effect in neighborhood  $j$  in Equation 8 consists of a fixed average age effect across all neighborhoods,  $\beta_1$ , and a differential age effect that is specific to each neighborhood, ( $u_{1j}$ ). Such models are also referred to as *random-slopes* or *random coefficient models* or *mixed models* since the model in Equation 8 is achieved by allowing the fixed age effect to vary across neighborhoods.

While random-slopes models address the issue of contextual heterogeneity in multilevel analysis, random-intercepts models disentangle the compositional and contextual sources of variation.

### Key Characteristics of a Multilevel Statistical Model

Multilevel models are essentially concerned with modeling both the average and the variation around the average. To accomplish this, they consist of two sets of parameters: those summarizing the average relationships(s) and those summarizing the variation

around the average at both the level of individuals and neighborhoods. Thus, in Equation 8, the parameters  $\beta_0$  and  $\beta_1$  are fixed and give the average poor health/age relationship. The remaining subscripted parameters in the brackets are random (allowed to vary) and represent the differences in poor health between neighborhoods and between individuals within neighborhoods.

Representing the between-neighborhood differences in Equation 8 are two terms,  $(u_{0j}, u_{1j})$ , associated with the constant, and  $x_{1ij}$ , respectively. However, it is not the neighborhood-specific values that are estimated by multilevel models. Rather, they estimate the variances and the covariance. Making the usual IID (identical and independent distribution) assumptions, the neighborhood differences at level-2 can be summarized through a *variance-covariance parameter matrix* consisting of two variances ( $\sigma_{u0}^2$ ,  $\sigma_{u1}^2$ ) and one covariance ( $\sigma_{u0u1}$ ), respectively. The level-2 variance-covariance coefficients, meanwhile, can be used to derive neighborhood-specific predictions, usually referred to as *posterior residuals*, thereby allowing the researcher to make neighborhood-specific inferences. The level-1 residuals ( $e_{0ij}$ : remaining difference for individual  $i$  in neighborhood  $j$ ) can be summarized in a variance parameter,  $\sigma_{e0}^2$ . The model assumes that the variance at level-1 is *homoskedastic* (i.e., constant at all ages). This assumption can be relaxed and if the variance at level-1 is *heteroskedastic* (i.e., different at different ages), then that can be accordingly modeled within the multilevel statistical approach.

### Main Contextual Effects and Cross-Level Interaction Models

An attractive feature of multilevel models—one that is commonly used in health research—is their ability to model neighborhood and individual characteristics, and any interaction between them, simultaneously. Consider a micro model with a categorical individual variable, social class:

$$y_{ij} = \beta_{01} + \beta_{1j}x_{1ij} + e_{0ij}. \quad (9)$$

The parameter  $\beta_{0j}$  gives the average health for neighborhood  $j$  for a base category (e.g., low social class) and  $\beta_{1j}$  estimates the differential for high social class in neighborhood  $j$  (associated with an indicator variable,  $x_{1ij}$ ). As before, this requires specifying two macro models at the neighborhood level. Since

neighborhood characteristics vary at level-2, they are consequently specified as predictor variables in the level-2 model and not in the micro model specified in Equation 9. Thus, the two elaborated macro models underlying Equation 9 are

$$\beta_{0j} = \beta_0 + \alpha_1 W_{1j} + u_{0j} \quad (10)$$

$$\beta_{1j} = \beta_1 + \alpha_2 W_{1j} + u_{1j}, \quad (11)$$

where  $W_{1j}$  is a neighborhood poverty covariate that is hypothesized to account for the complex variation in neighborhoods. The separate specification of micro and macro models correctly recognizes that the contextual variables are predictors of between-neighborhood differences, after allowing for individual compositional variables. Combining the macro equations in Equations 10 and 11 yields the following:

$$y_{ij} = \beta_0 + \beta_1 x_{1ij} + \alpha_1 W_{1j} + \alpha_2 W_{1j} x_{1ij} + (u_{0j} + u_{1j} x_{1ij} + e_{0ij}). \quad (12)$$

Specifically, the  $\alpha$  parameters now account for the contextual variations for the two social class groups and represent the relationship between neighborhood differences (after controlling for individual variable, social class) and the contextual variable,  $W_j$ . Thus,  $\alpha_2$  assesses the relationship between low social class (at the individual level) and the poverty of the neighborhood, and represents the differential contextual effect of poverty for high social class. This formulation makes clear that it is only through multilevel models that *cross-level interactions* between individual ( $x_{1ij}$ : the indicator dummy for high social class) and contextual characteristics ( $W_{1j}$ : the neighborhood poverty covariate) can be robustly specified and estimated. If both the parameters are significant, then such models are called the *cross-level interaction models*. If, however, the parameter  $\alpha_2$  is not significant, then this would suggest that the neighborhood poverty effect is the same for the two social class groups. The precise nature of the relationship will obviously depend on the size and direction of the individual and contextual fixed parameters,  $\beta$  and  $\alpha$ , respectively.

### Nonlinear Multilevel Models

While the preceding discussion considered a single normally distributed response variable for illustration, multilevel models are capable of handling a wide

range of responses. These include *binary outcomes*; *proportions* (as logit, log-log, and probit models); *multiple categories* (as multinomial and ordered multinomial models); and *counts* (as Poisson and negative binomial distribution models). In essence, these models work by assuming a specific, nonnormal distribution for the random part at level-1, while maintaining the normality assumptions for random parts at higher levels. Consequently, the discussion presented in this entry focusing at the neighborhood level (higher contextual level) would continue to hold regardless of the nature of the response variable, with few exceptions. For instance, partitioning variances across individual and neighborhood levels in complex *nonlinear multilevel logistic models* is not straightforward and is a subject of applied methodological research.

#### MULTILEVEL ANALYSIS: GENERAL ISSUES

While the advances in statistical research and computing have shown the potential of multilevel methods for health and social behavioral research, there are issues to be considered while developing and interpreting multilevel applications. First, it is important to clearly motivate and conceptualize the choice of higher levels (e.g., neighborhoods) in a multilevel analysis. Second, establishing the relative importance of context and composition is probably more apparent than real, that is, the procedure to distinguishing the relative importance of context and compositional factors is somewhat problematic, and necessary caution must be exercised while conceptualizing and interpreting the compositional and contextual sources of variation. Third, it is important that the sample of neighborhoods belongs to a well-defined population of neighborhoods such that the sample shares exchangeable properties that are essential for robust inferences. Fourth, it is important to ensure adequate sample size at all levels of analysis. In general, if the research focus is essentially on neighborhoods, then clearly the analysis requires more neighborhoods (as compared to more individuals within a neighborhood). Last, like all quantitative procedures, the ability of multilevel models to make causal inferences is limited and innovative strategies including randomized neighborhood-level research designs in combination with multilevel analytical strategy may be required to convincingly demonstrate causal effects of neighborhoods.

#### SUMMARY

The multilevel statistical approach—an approach that explicitly models the correlated nature of the data arising either due to sampling design or because populations are clustered—has a number of substantive and technical advantages.

From a substantive perspective, it circumvents the problems associated with *ecological fallacy* (the invalid transfer of results observed at the ecological level to the individual level); *individualistic fallacy* (occurs by failing to take into account the ecology or context within which individual relationships happen); and *atomistic fallacy* (arises when associations between individual variables are used to make inferences on the association between the analogous variables at the group/ecological level). The issue common to the above fallacies is the failure to recognize the existence of unique relationships being observable at multiple levels and each being important in its own right. Specifically, one can think of an *individual relationship* (e.g., individuals who are poor are more likely to have poor health); an *ecological/contextual relationship* (e.g., places with a high proportion of poor individuals are more likely to have higher rates of poor health); and an *individual-contextual relationship* (e.g., the greatest likelihood of being in poor health is found for poor individuals in places with a high proportion of poor people). Multilevel models explicitly recognize the level-contingent nature of relationships.

From a technical perspective, the multilevel approach enables researchers to obtain statistically efficient estimates of fixed regression coefficients. Specifically, using the clustering information, multilevel models provide correct standard errors, and thereby robust confidence intervals and significance tests. These generally will be more conservative than the traditional ones that are obtained simply by ignoring the presence of clustering. More broadly, multilevel models allow a more appropriate and realistic specification of complex variance structures at each level. Multilevel models are also precision weighted and capitalize on the advantages that accrue as a result of “pooling” information from all the neighborhoods to make inferences about specific neighborhoods.

The discussion of multilevel methods and analysis in this entry was essentially illustrated with a hierarchical two-level structure of individuals at level-1 nested within neighborhoods at level-2. Additional

statistical and analytical considerations can be identified while dealing with three-level, repeated-measures, multivariate, or cross-classified data structures. Also of note are research developments whereby multilevel perspective has been extended to survival and event history models, meta-analysis, structural equation modeling, and factor analysis.

—S. V. Subramanian

See also ECOSOCIAL THEORY; INCOME INEQUALITY AND HEALTH; NEIGHBORHOOD EFFECTS ON HEALTH AND BEHAVIOR

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## MULTIPLE RISK FACTOR INTERVENTION TRIAL (MRFIT)

The Multiple Risk Factor Intervention Trial (MRFIT) was a randomized controlled trial designed to assess ability of multiple behavioral interventions to prevent the development of coronary heart disease (CHD) in individuals at high risk. From 1973 to 1975, an initial screening involved 361,662 men 35 to 57 years of age at 22 clinical centers in 18 U.S. cities; 12,866 men were selected who were without definite evidence of CHD but who had an elevated risk of CHD death based on their high blood pressure, elevated serum cholesterol, and/or cigarette smoking. In other words, these were men at risk who were not sick.

Half of these men were randomly assigned to either their usual source of medical treatment (i.e., the usual care, or UC, group) or to an intervention designed to reduce CHD risk factors (i.e., the special intervention, or SI, group). All men attended annual visits for assessment of (a) standard risk factors including cholesterol, smoking status, and blood pressure; (b) symptoms of CHD (i.e., morbidity) including self-reported angina as well as stroke or definite clinical myocardial infarction; and (c) behaviors and psychosocial variables including diet, illness, socioeconomic status (e.g., participant's education and income), physical activity, life events (e.g., demotion, marriage, divorce, vacation). In addition to these annual visits, SI men attended intervention visits at 4-month intervals.

Goals for the SI included smoking cessation for men who smoked cigarettes and weight reduction for men who weighed > 115% of their desirable weight. A nutritional goal for all SI men was a reduction in intake of saturated fats and cholesterol, moderate reductions in total fat, and modest increases in polyunsaturated fats. In addition to behavioral interventions, drug treatment was initiated for SI men with a diastolic blood pressure (DBP) of  $\geq 90$  mm Hg. Drug therapy was increased ("stepped-up") until DBP was consistently below 80 mm Hg. Interventions designed to achieve the goals included an initial 10-week intensive intervention, an extended intervention for those with risk factors that persisted after the initial 10 weeks, and a maintenance program following the reduction in risk factors.

The intervention program included four behavioral methods. First, intervention during the initial 10-week period involved group meetings. Group intervention was preferred based on evidence that group cohesiveness improves group attendance, self-esteem, and therapeutic outcome. Second, "behavioral diagnosis" occurred during case conferences scheduled with biomedical, nutritional, and behavioral scientists following the initial 10-week intervention. Behavioral diagnosis involved identification of problematic behaviors (e.g., smoking), people and situations that support the particular behavior, consequences of stopping the behavior, and the consequences of not stopping the behavior. Third, individual behavioral techniques were implemented to address these problematic behaviors. Behavioral techniques included self-monitoring (e.g., daily diaries), goal setting and contracting, frequent feedback, support and positive reinforcement for behavioral change, development of a self-reward system, modeling of correct health behaviors, and relaxation. Fourth, wives or partners of participants were encouraged to participate in the intervention and effort was made to have wives or partners attend intervention meetings, particularly those designed to modify eating patterns and smoking. When applicable, interventions were offered that would help wives or partners modify their own behaviors to facilitate achievement of desired changes in the MRFIT participants.

At baseline, men's elevated risk for CHD was reflected in their high blood pressure (135/91 mm Hg, on average), elevated serum cholesterol (254 mg/dL, on average), and relatively high rate of smoking (59 %). When MRFIT ended in 1982, all men had been followed for at least 6 years and the average length of time from randomization to the end of the trial was 7 years. At the 6-year examinations, BP dropped to 122/80 mm Hg in SI men and 127/84 mm Hg in UC men. Cholesterol was reduced to 235 mg/dL in SI men and to 241 mg/dL in UC men. Finally, smoking rates decreased to 32.6 % in SI (a 50% quit rate) and 46.7% in UC men (a 29% quit rate). Despite an unexpected decline in risk factors among UC men, the greater reduction among SI men provided good evidence that multiple risk factors for CHD could be simultaneously modified.

Deaths and their causes were ascertained during the trial and thereafter. During the trial, death from CHD did not differ significantly between groups, with 17.9 deaths per 1,000 in the SI group and 19.3 deaths

per 1,000 in the UC group. Total mortality in the trial also did not differ, with 41.2 deaths per 1,000 in the SI group and 40.4 deaths per 1,000 in the UC group. Therefore, despite greater reductions in risk factors among SI men relative to UC men, this did not translate into lower mortality among SI men relative to UC men. This nonsignificant result could have been a result of lower than expected mortality and the unexpected reductions in risk factors among UC men. Alternatively, the effects of risk factor modification may only emerge after 7 years. To address this question, long-term mortality was assessed for the period from randomization through December 1990, representing a 16-year follow-up. During this longer follow-up period, CHD death rates still did not differ between UC and SI men. However, SI was associated with a significantly lower rate of heart attacks (a major specific type of CHD death), with 29 deaths per 1,000 in the SI group and 36 deaths per 1,000 in the UC group.

Although the MRFIT was a randomized clinical trial designed to test the effect of an intervention on multiple risk factors, questionnaires and interviews were administered to test additional hypotheses within prospective cohort and case control designs. In other words, characteristics of the MRFIT men at baseline and during the trial (assessed during annual visits) have been considered in relation to subsequent death during follow-up. Two cohorts have been considered: men recruited during the initial screening ( $N = 361,662$ ) and men recruited into the MRFIT ( $N = 12,866$ ). Within these cohorts, associations with mortality and morbidity have been considered for various characteristics, including risk factors (e.g., cholesterol, abnormal electrocardiogram), Type A behavior pattern and/or hostility, exercise, and life events.

—Brooks B. Gump

See also ALAMEDA COUNTY STUDY; BOGALUSA HEART STUDY; FRAMINGHAM HEART STUDY; HARVARD ALUMNI HEALTH STUDY; KUOPIO ISCHEMIC HEART DISEASE RISK FACTOR STUDY

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## MULTIPLE SCLEROSIS: PSYCHOSOCIAL ASPECTS

Multiple sclerosis (MS) is a chronic, often disabling disease of the central nervous system (CNS) affecting approximately 350,000 people in the United States. Prevalence among women is about twice of that found in men. It is believed that the immune system attacks the myelin sheath around the axons of the CNS, resulting in lesions. Potential symptoms include, but not are limited to, loss of function or feeling in limbs, loss of bowel or bladder control, sexual dysfunction, debilitating fatigue, blindness due to optic neuritis, loss of balance, pain, cognitive dysfunction, and emotional changes. MS remains one of the most disabling illnesses in the United States.

There are several possible courses. Between 65% and 70% begin with a relapsing-remitting course marked by periodic disease exacerbations, which remit partially or fully over the course of weeks or months. Most relapsing-remitting courses eventually give way to a secondary-progressive course in which there is also worsening between exacerbations. Approximately 10% to 15% have a primary-progressive course in which there is a steady worsening of symptoms with no exacerbations. Small percentages of patients have other courses, including a benign course with few symptoms, or in rare cases, a malignant course characterized by rapid deterioration resulting in death.

### NEUROPSYCHOLOGICAL SYMPTOMS

Point prevalence for neuropsychological impairment ranges from 40% to 60% while lifetime prevalence is likely considerably higher. Problems with processing speed, attention, and concentration; verbal fluency; and verbal memory are among the most common problems. However, visual-spatial learning, construction, and organization, as well as executive functions, can also be affected. Memory deficits are

commonly thought to be due to retrieval problems, yet some studies have also documented problems in encoding and storage of information. More cognitively impaired patients may also show euphoria or pathological laughing and crying, a state characterized by bouts of uncontrollable laughing, crying, or both in response to nonspecific stimuli in the absence of a matching mood state. The neuropsychological symptom profile in MS is heterogeneous. Severity of deficits can vary too. For some MS patients, neuropsychological symptoms may be the first symptoms to appear, while other patients may show preserved cognitive functioning decades after diagnosis.

Neuropsychological evaluation is recommended for patients reporting cognitive deficits. This can identify the source of problems, which can facilitate the development of adaptive strategies. For example, most patients refer to cognitive symptoms as "memory problems." However, deficits in other areas such as attention and concentration or executive functioning can often masquerade as memory problems. Nevertheless, development of compensatory strategies may improve adaptation. Neuropsychological evaluation may also assist employers and family members in adjusting the environment to optimize performance and developing realistic expectations about the patient's abilities.

To date, computer- or human-assisted cognitive rehabilitation has not been shown to be effective in reducing cognitive impairment; however, rigorous trials have not been performed. Learning compensatory skills is generally presumed to be helpful, but such strategies have also not received rigorous testing.

### PSYCHOLOGICAL SYMPTOMS

Patients with MS frequently present with a variety of psychological difficulties. It is widely believed that depression is the most common and most debilitating psychological problem associated with MS. Cumulative lifetime prevalence of major depressive disorder following MS diagnosis is approximately 50%, which is higher than seen in other medical patients or the general population. MS-related depression and distress account for a larger decrement in quality of life than does physical disability and are associated with decreased adherence to medical regimens. Depression may also have fatal consequences: The rate of suicide is 7.5 times that in the general population.

MS-related depression may have some unique etiological characteristics. MS-related depression is associated with reduced social support, avoidant coping, depressive cognitive styles, and many other psychosocial risk factors common to other populations. Depression is not related to the level of physical or cognitive impairment. However, there is evidence that MS pathophysiology and pathogenesis are related to depression. Specific MS brain lesions in the temporal and frontal regions are associated with increased risk of depression. Depression is also associated with disease exacerbation and CNS inflammation. Many of the cytokines involved in MS inflammation, including interferon gamma (IFN- $\gamma$ ) and tumor necrosis factor alpha (TNF- $\alpha$ ), are also known to produce depressive symptoms including depressed mood, changes in appetite and sleep, and social withdrawal. Thus, we have proposed that depression is a symptom of MS, and not a psychological response to loss of function. This would explain the greater prevalence of depression in MS populations relative to other medical populations.

Anxiety symptoms are also common but have received less attention. Injection anxiety and phobia have emerged as significant problems since the primary disease-modifying medications for MS must all be administered by injection. Between 30% and 50% of all patients are unable to self-inject due to anxiety or phobia, and inability to self-inject results in decreased adherence. Anxiety can also aggravate depression in MS and is associated with increased rates of suicidal ideation.

### Treatment for Depression

While depression is common, many studies have shown that it is treatable. Cognitive-behavioral therapy (CBT) and antidepressant medications are equally effective in reducing depressive symptoms, while supportive or insight-oriented treatments appear to be somewhat less. It should be noted that studies have focused on main effects and not on patient predictors of differential response. Therefore, it cannot be said that supportive or insight-oriented treatments are necessarily ineffective for any individual patient, but only that depression in patients with MS, as a population, is more likely to respond to CBT or antidepressant medications. For specific symptoms of pathological laughing and crying, antidepressant medication has been shown to be helpful.

Many patients with MS have mobility impairments or experience fluctuations in symptoms that prevent them from attending a clinic on a regular basis. Others may live far from specialized treatment. Alternative treatment delivery methods via telephone or the Internet might increase access to mental health treatment for these patients. A recent small trial has shown that telephone-administered CBT is effective in reducing depressive symptoms compared with a treatment as usual control condition. Moreover, adherence to disease-modifying medications was better for the active treatment group than the control condition.

### Effects of Treatment for Depression on Multiple Sclerosis

There are at least two potential pathways by which depression might affect MS disease: indirectly by affecting behaviors that affect MS exacerbation or progression, or directly via effects on the immune system. There is some support for the indirect hypothesis. A longitudinal study of patients initiating an interferon medication found that depression was associated with decreased adherence to medications used to treat MS. But if the depression was treated either with psychotherapy or antidepressant medications, the risk of discontinuation was no greater than for patients reporting no depression. However, it should be emphasized that neither depression nor adherence have been linked to exacerbation rate or sustained progression of the disease.

Distress and depression may directly affect MS pathogenesis. Distress has been shown to predict sustained progression of MS impairment over the course of 1 year. Depression has been associated both with observed inflammation in the brain by Gd+ MRI and with increases in interferon gamma (IFN- $\gamma$ ; a lymphin in MS exacerbation that has been shown both to precede and to cause MS exacerbation). Furthermore, successful treatment for depression reduces T cell production of IFN- $\gamma$ . However, to date no study has examined the effect of treatment for depression on MS exacerbation or sustained progression.

### Injection Anxiety

Recent work has suggested that brief, six-session CBT focused on desensitization, exposure, and cognitive restructuring is effective in teaching phobic patients to self-inject.

## THE EFFECTS OF STRESS ON MULTIPLE SCLEROSIS

Many patients report that stress results in disease exacerbation. Both case control and longitudinal studies have shown that stress increases the risk of experiencing exacerbation. However, different types of stress may have differential effects. While chronic marital and job-related stress may increase the risk of clinical exacerbation, major negative life events, such as a death in the family, do not appear to alter disease activity. Furthermore, trauma, such as being under missile attack in a war zone, may reduce the risk of clinical exacerbation. Thus, it may be important to differentiate between relatively severe stressors and moderate but more chronic stressors when examining the relationship between stress and disease activity.

These relationships were recently confirmed in a study following patients with monthly gadolinium enhanced (Gd+) MRI scans (gadolinium is a dye that permits visualization of the breakdown in the blood-brain barrier). Major stressors, such as a death in the family, had no significant effect on subsequent Gd+ MRI brain lesions. However, interpersonal family and work conflict was shown to increase the risk of developing a new brain lesion 8 weeks later. While there is strong evidence that stress may increase risk of MS inflammation and exacerbation, the effect sizes are at best modest, suggesting the presence of moderating factors. There are many potential moderating factors, including genetic, disease, environmental, and psychological factors. A recent study has suggested that adaptive coping may reduce the effect of interpersonal

conflict on the subsequent development of new Gd+ brain lesions.

—David C. Mohr

See also AUTOIMMUNE DISEASES: PSYCHOSOCIAL ASPECTS;  
CHRONIC DISEASE MANAGEMENT; DEPRESSION: TREATMENT;  
PSYCHONEUROIMMUNOLOGY; STRESS, APPRAISAL, AND COPING

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## NATIONAL CHOLESTEROL EDUCATION PROGRAM (NCEP)

The greatest triumph of 20th-century cardiovascular medicine may not be recognized as the development of innovative surgical interventions, such as heart transplant, coronary artery bypass graft surgery, and various endovascular procedures, including percutaneous transluminal coronary angioplasty and stents, but rather as the movement toward prevention of coronary heart disease (CHD) through early detection and treatment of cardiovascular risk factors, including blood pressure and cholesterol. The National Cholesterol Education Program (NCEP) Adult Treatment Panel (ATP) of the National Heart, Lung, and Blood Institute (NHLBI) represents one such strategy that combines public health interventions at the social level (weight control, reduction of dietary saturated fat and cholesterol intake, increases in fiber consumption and physical activity) with aggressive medical management at the individual patient level through pharmacotherapy with therapeutic lifestyle changes and, if necessary, by adding drugs that lower cholesterol, such as HMG CoA reductase inhibitors or statins. Practice guidelines, such as NCEP-ATP, specify recommendations for behavioral changes for the general population, health care providers, and patients, which result in improved levels of cardiovascular risk and disease.

The current NCEP clinical practice guidelines (ATP-III) were released in May 2001, following the release of two previous guidelines (ATP-I, 1988, and ATP-II, 1993). NCEP recommends that all adults

aged  $\geq 20$  years have their blood cholesterol measured every 5 years, with preference given to a complete lipoprotein panel, which measures fasting total cholesterol, low-density lipoproteins (LDL), high density lipoproteins (HDL), and triglycerides. (An alternative lab panel includes only a nonfasting total and HDL cholesterol with a complete lipoprotein panel for those with total cholesterol  $> 200$  mg/dL or HDL  $< 40$  mg/dL.)

LDL-lowering therapy results in reductions in total and coronary mortality, major coronary events, coronary procedures, and stroke. While the newest and most widely used pharmacologic agents are the HMG CoA reductase inhibitors (statins), other pharmacologic treatments include bile acid sequestrants, fibric acids, and nicotinic acid (niacin). Statins reduce LDL by 18% to 55% and triglycerides by 7% to 30%, and increase HDL by 5% to 15%. Statins have been demonstrated to reduce total and CHD mortality, as well as major coronary events and stroke. Patients treated with statins undergo fewer coronary procedures, including bypass and angioplasty.

NCEP ATP-III guidelines apply to both primary and secondary prevention, and identify a total cholesterol of  $< 200$  mg/dL as desirable, 200 to 239 mg/dL as borderline high, and  $\geq 240$  mg/dL as high. LDL cholesterol levels are identified as optimal ( $< 100$  mg/dL), near/above optimal (100-129 mg/dL), borderline high (130-159 mg/dL), high (160-189 mg/dL), and very high ( $\geq 190$  mg/dL). HDL cholesterol levels of 40 to 59 mg/dL are ideal, whereas HDL levels  $< 40$  mg/dL are considered low, and an independent cardiovascular risk factor. Triglyceride levels  $< 150$  mg/dL are considered normal, 150 to 199 mg/dL are

borderline high, 200 to 499 mg/dL are high, and  $\geq 500$  mg/dL are very high.

In NCEP ATP-III, the focus is on primary prevention, the goal of therapy being the lowering of low-density lipoprotein (LDL) cholesterol. NCEP ATP-III guidelines focus on cholesterol control by identifying those with elevated LDL, and targeting therapy (therapeutic lifestyle changes and medications) to meet LDL treatment goals, which vary according to overall cardiovascular risk (low, moderate, high). One of the major innovations of NCEP ATP-III is the emphasis on the clinical use of the Framingham risk score, which estimates the 10-year risk of CHD. This score can be easily calculated, and classifies individuals into low ( $< 10\%$ ), moderate (10-20%), or high ( $> 20\%$ ) risk of CHD in 10 years. Utilization of the Framingham risk score enables physicians to more accurately identify high-risk patients (it has greater predictive power than counting risk factors alone) and to intervene early and aggressively improving prevention of CHD events.

The major risk factors that modify LDL cholesterol treatment goals are cigarette smoking, hypertension, low HDL ( $< 40$  mg/dL), family history of premature CHD, age ( $\geq 45$  for men,  $\geq 55$  for women), and the presence of CHD (all clinical forms of atherosclerotic disease, including peripheral arterial disease, abdominal aortic aneurysm, symptomatic carotid artery disease, or diabetes, which is considered a "CHD risk equivalent," since its 10-year risk for CHD is about 20%). Another significant innovation in NCEP is the recognition of a growing public health problem, the "metabolic syndrome," which includes central abdominal obesity, hypertension, hyperlipidemia, and insulin resistance, as both a set of risk factors and a secondary target for therapeutic lifestyle changes and pharmacotherapy. (The age-adjusted prevalence of the metabolic syndrome is estimated by NHANES III to be nearly 25% for both men and women.)

Treatment goals for reducing LDL are as follows: For those with established CHD or CHD-risk equivalents, the LDL treatment goal is  $< 100$  mg/dL; for those with multiple (2+) risk factors, the LDL treatment goal is  $< 130$  mg/dL; and for those with zero or one risk factor the LDL treatment goal is  $< 160$  mg/dL.

The awareness of one's own cardiovascular risk factors is a crucial first step in the prevention and management of cardiovascular disease. Reducing the burden of disease at the community level begins with

a combination of public health interventions that reduce the average level of risk in the community with measurement and detection of risk factors at the individual level, and aggressive intervention in individuals identified at high risk.

Reducing the burden of disease at the community level begins with a combination of interventions that separately but simultaneously target both the general population and individuals at various levels of risk. Strategies to reduce the overall level of risk in the general population include public education and mass media campaigns (e.g., nutritional intervention programs such as Five a Day to promote increased consumption of fruits and vegetables), environmental changes (e.g., increased tobacco taxes, restrictions on smoking in public and workplaces, alterations in food composition), and mass medical screenings for risk factors (e.g., body mass index and waist-to-hip ratio for obesity, blood pressure for hypertension, blood sugar for diabetes, and blood cholesterol for hyperlipidemia). Targeting the individual involves increasing patient awareness of the importance of knowing his or her own risk factors and overall level of risk, knowing which risk factors can be modified and how to modify those risk factors, and working with his or her health care providers to reduce risk factors and overall level of risk. Recognizing the individual's readiness to change, and moving him or her from the precontemplator to the contemplator level is a crucial step in this process.

Healthy People 2000 represents a public health strategy aimed at bridging the population- and individual-focused approaches to improving the health status of Americans. One specific goal of Healthy People 2000 was to increase to 75% the percentage of adults aged  $\geq 20$  screened for high blood cholesterol within the preceding 5 years. Subsequently, Healthy People 2010 includes as a goal the reduction of the percentage of adults aged  $\geq 20$  with total blood cholesterol levels  $\geq 240$  mg/dL.

Recent prevalence data (1999) on cholesterol screening, based on the CDC's telephone-administered Behavioral Risk Factor Surveillance System (BRFSS), indicate that 74% of adults (age 20+) in the United States reported that they had had their blood cholesterol checked (this does not necessarily mean that the subtypes of cholesterol have been measured), and of those, 70% had this test within the past year, 24% had their test within the past 2 to 5 years, and 30% had been told that they have high blood cholesterol.

Men reported slightly higher percentages of elevated cholesterol (33.3%) as compared to women (28.4%). Self-reported rates of high blood cholesterol were slightly higher among Whites (29.7%) as compared to Blacks (26.0%), Hispanics (25.6%), and Asian/Pacific Islanders (27.3%). An additional trend observed was an increase in the percentage of individuals who were told that they have high blood cholesterol from 1991 to 1999. This trend most likely reflects better awareness and increased utilization of detection procedures, rather than a true increase in high blood cholesterol within the general population.

The Third National Health and Nutrition Examination Survey (NHANES III), conducted between 1988 and 1994, has shown declines in dietary intake of saturated fat and total fat, as well as reductions in blood cholesterol levels. From 1978 to the present, mean total cholesterol levels among U.S. adults have fallen from 213 mg/dL to 203 mg/dL, and the prevalence of high blood cholesterol (total cholesterol  $\geq$  240 mg/dL) has declined from 26% to 19%.

Taken together, these data indicate that significant behavioral changes in both patients and health care providers are taking place. Cholesterol levels are being measured more frequently, individuals with high blood cholesterol are being identified, and therapeutic lifestyle changes and pharmacotherapy are being utilized more frequently. At the same time, several studies have reported significant racial/ethnic disparities in the identification of high blood cholesterol and prescribing of cholesterol-lowering drugs for minorities.

ATP-III examined the necessity for special treatment considerations for different population groups varying by gender, age, and ethnicity. Several subgroups within the general population require specific modifications to cardiovascular risk factor management. These groups include patients with established CHD or at high risk for developing CHD and/or diabetes, younger adults (men aged 20-35, women aged 20-45), older adults (men  $\geq$  65, women  $\geq$  75), women aged 45 to 75, and those who are postmenopausal, and ethnic minorities. While the profiles of risk factors differ across these populations, the benefits of LDL reduction were recommended for all age, gender, and ethnic subgroups.

Several new developments that may give individuals greater choice and control over their risk factor monitoring and management deserve mention. These include the identification and testing of new

cholesterol-lowering drugs with fewer side effects (such as myopathy and increased liver enzymes), and switching of drugs (such as statins) that require a physician's prescription to over-the-counter status (OTC switch), which, coupled with the availability of FDA-approved home cholesterol testing kits, have the capacity to make cholesterol self-management even more widely available and possibly at a lower cost.

New, emerging cardiovascular risk factors and pathophysiologic mechanisms, such as impaired glucose tolerance, lipoprotein (a), inflammation, thrombosis, and elevated serum homocysteine, as well as newer screening and/or diagnostic tests (such as C-reactive protein or CRP), are being examined in relationship to lipoproteins and LDL cholesterol reduction. Benefits of both risk factor reduction through diet and statin pharmacotherapy may extend beyond LDL management and cardiovascular disease. Statins may operate at multiple levels, including modification of the lipoprotein profile, reduction of vascular inflammation, and stabilization of vulnerable atherosclerotic plaque.

Individual clinical and public health interventions combined have the capacity to dramatically reduce levels of cardiovascular risk factors as well as cardiovascular morbidity and mortality. Readiness to change is required at all levels: the public, health care system, provider, and patient. Behavioral change must be promoted and supported at multiple levels. At the public level, changes in nutrition, physical activity, and smoking are needed. The physician and other health care providers need to routinely screen for lipids, calculate overall cardiovascular risk, and treat with both therapeutic lifestyle changes and appropriate medications. The individual patient needs to become aware of his or her lipid profile and overall cardiovascular risk, and needs to adhere to both lifestyle changes and medication regimens that reduce risk. Perhaps the greatest triumph of 21st century cardiovascular medicine will result from a better understanding of factors that inhibit or promote behavior change in individuals, and the effective incorporation of this knowledge into clinical practice.

—Jonathan N. Tobin  
and Tania Zazula

*See also* ADHERENCE TO TREATMENT REGIMENS; ADOPTION OF HEALTH BEHAVIOR; BLOOD PRESSURE AND HYPERTENSION; PHYSICAL ACTIVITY; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CARDIAC REHABILITATION; CHRONIC DISEASE

MANAGEMENT; HEALTH PROMOTION AND DISEASE PREVENTION; LIPIDS: PSYCHOSOCIAL ASPECTS; MULTIPLE RISK FACTOR INTERVENTION TRIAL (MRFIT); OBESITY: CAUSES AND CONSEQUENCES; OBESITY TREATMENT AND PREVENTION; PHYSICAL ACTIVITY AND HEALTH; TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

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## NATIONAL INSTITUTES OF HEALTH: HEALTH AND BEHAVIOR RESEARCH

The National Institutes of Health (NIH) is the primary federal agency responsible for basic research on the health and well-being of the population of the United States. With a 2002 budget of \$23.5 billion, it pursues its mission to uncover fundamental knowledge about the nature and behavior of living systems and apply that knowledge to improve human health. Approximately 84% of the funds are distributed as grants and contracts to investigators in universities and other institutions. In addition, the NIH supports a smaller intramural program of research at the NIH campus in Bethesda, Maryland, and ancillary sites. As part of the quest to prevent and cure the full range of diseases and disorders, NIH has developed a long-term program of research on the behavioral and social aspects of health and illness. Health and behavior research, focusing on the behavioral and social sciences research linked to morbidity, mortality, and their causes and consequences, is a major component of the behavioral and social science research program of the NIH.

Historically, behavioral research has been supported since at least 1955 when the National Heart Institute (predecessor to the National Heart, Lung, and Blood Institute) funded its first behavioral research grant. Since those early beginnings, the behavioral and social sciences research program across the NIH has grown to an estimated \$2.4 billion in fiscal year 2002.

While there has been a long and rich history of support for behavioral and social sciences research at NIH, in recognition of the key role that behavioral and social factors play in health, Congress saw a need to more fully integrate behavioral and social science into the programs of the NIH. In 1995, the congressionally mandated Office of Behavioral and Social Sciences Research (OBSSR) opened as a program office in the Office of the Director, NIH.

The mission of the OBSSR was to stimulate a broad integrated program of behavioral and social sciences research into the health research enterprise of the NIH. One of the first activities of the new office was to develop a definition of behavioral and social science research supported by the NIH. That definition is found below.

## AREAS OF RESEARCH

The NIH supports both basic and clinical behavioral and social science research. Many studies have both basic and clinical components, and those investigations are often complementary.

### Basic Research

Basic research in the behavioral and social sciences furthers understanding of behavioral and social functioning. As is the case for basic research in the biomedical sciences, basic behavioral and social sciences research does not address disease outcomes per se, but instead provides essential knowledge of fundamental processes and states.

#### *Behavioral and Social Processes*

Research on behavioral and social processes involves the study of human or animal functioning at the level of the individual, small group, institution, organization, or community. At the individual level, this research may involve the study of behavioral factors such as cognition, memory, language, perception, personality, emotion, motivation, and others. At higher levels of aggregation, it includes the study of social variables such as the structure and dynamics of small groups (e.g., couples, families, work groups), institutions and organizations (e.g., schools, religious organizations), communities (defined by geography or common interest), and larger demographic, political, economic, and cultural systems. Research on behavioral and social processes also includes the study of the interactions within and between these two levels of aggregation, such as the influence of sociocultural factors on cognitive processes or emotional responses. Finally, this research also includes the study of environmental factors such as climate, noise, environmental hazards, and residential environments and their effects on behavioral and social functioning.

#### *Biopsychosocial Processes*

Biopsychosocial research (also known as bio-behavioral or biosocial research) involves the study of the interactions of biological factors with behavioral or social variables and how they affect each other (i.e., the study of bidirectional multilevel relationships).

#### *Development of Procedures for Measurement, Analysis, and Classification*

Research on the development of procedures for measurement, analysis, and classification involves the development and refinement of procedures for measuring and analyzing behavior, psychological functioning, or the social environment. This research is designed to develop research tools that could be used in other areas of behavioral and social sciences or in biomedical research.

### Clinical Research

Clinical research in the behavioral and social sciences is designed to predict or influence health outcomes, risks, or protective factors. It is also concerned with the impact of illness or risk for illness on behavioral or social functioning. Clinical research may be divided into five categories.

#### *Identification and Understanding of Behavioral and Social Risk and Protective Factors*

Research on the identification and understanding of behavioral and social risk and protective factors associated with the onset and course of illness, and with health conditions, examines the association of specific behavioral and social factors with mental and physical health outcomes and the mechanisms that explain these associations. It is concerned with behavioral and social factors that may be health-damaging (risk factors) or health-promoting (protective factors).

#### *Effects of Illness or Physical Condition on Behavioral and Social Functioning*

Research in this category focuses on the consequences of illness for behavior. Included are such questions as the psychological and social consequences of genetic testing, behavioral correlates of head injury across developmental stages, emotional



and social consequences of HIV infection or cancer, coping responses associated with chronic pain syndromes, effects of illness on economic status, and coping with loss of function due to disability.

#### *Treatment Outcomes Research*

Treatment outcomes research involves the design and evaluation of behavioral and social interventions to treat mental and physical illnesses, or interventions designed to ameliorate the effects of illness on behavioral or social functioning. This area also includes research on behavioral and social rehabilitation procedures.

In summary, behavioral and social science factors are key contributors to health outcomes. The research programs of the NIH are increasingly including behavioral and social sciences approaches aimed at understanding disease etiology and improving human health. Building on the important prior research on single diseases or processes, significant advances will likely come from work that takes an integrative approach to health by incorporating the methods and concepts of behavioral and social research with a more traditional biomedical approach.

—Virginia S. Cain

See also CENTER FOR THE ADVANCEMENT OF HEALTH;  
CENTERS FOR DISEASE CONTROL AND PREVENTION; HEALTH  
AND BEHAVIOR ORGANIZATIONS

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## **NEIGHBORHOOD EFFECTS ON HEALTH AND BEHAVIOR**

Interest in geographical variations in health has a long history. However, the importance given to the examination of area differences in studying the

causes of disease has varied over time. The focus on individual-level risk factors over the past few decades was generally associated with little interest in area characteristics as potential disease determinants. Recent years, however, have witnessed a resurgence of interest in how area or neighborhood characteristics may affect the health of their residents ("neighborhood health effects"). Several factors may have contributed to this trend. Chief among these has been a rekindling of interest in the social determinants of health and the recognition that social influences on health operate through many different processes, one of which may be the types of areas or neighborhoods in which people live. Simultaneously, there has been a growing discussion on the use of ecological variables in epidemiology. This discussion is related to a critique of the notion that all health determinants are best conceptualized as individual-level attributes. Research on neighborhood effects has fit into this emerging paradigm because it has conceptualized neighborhood context as potentially related to health, over and above individual-level attributes. In addition, recent discussions in sociology on the causes and consequences of residential segregation and urban poverty, together with neighborhood effects research in criminology and child development, have reinvigorated interest in the ways in which neighborhood context may affect individuals, including their health.

#### **RESEARCH APPROACHES USED TO INVESTIGATE NEIGHBORHOOD HEALTH EFFECTS**

Different research strategies have been used to investigate neighborhood or area health effects: ecological studies, contextual or multilevel studies, and comparisons of small numbers of well-defined neighborhoods. Ecological studies have examined variation in morbidity and mortality rates across areas in order to relate this variability to area characteristics. The sizes of areas examined have ranged from relatively large areas (such as counties), not really analogous to neighborhoods at all, to smaller areas (such as census tracts or block groups). The most common area characteristics investigated have been aggregate measures of the socioeconomic characteristics of residents or indices of deprivation constructed by combining several aggregate measures based on theoretical and/or empirical considerations. These studies have found that area deprivation is associated with increased mortality.

However, the use of these aggregate measures has often been accompanied by ambiguity regarding whether these variables are conceptualized as measures of area-level properties or simply as summaries of individual-level variables, and hence whether the objective is to examine how area constructs are related to health outcomes or document the area-level (or ecological) expression of a well-known individual-level relation. In addition, ecological studies cannot directly determine whether differences across areas are due to characteristics of the areas themselves or to differences between the types of individuals living in different areas.

The recognition of the need to separate out the effects of “context” (e.g., area or neighborhood properties) and “composition” (characteristics of individuals living in different areas) when examining area effects on health has led to a proliferation of reports involving contextual and multilevel analyses. Contextual and multilevel analyses require data sets including individuals nested within areas or neighborhoods. By simultaneously including both neighborhood and individual-level predictors in regression equations with individuals as the units of analysis, these strategies allow examination of neighborhood or area effects after controlling for individual-level confounders. They also permit the examination of individual-level characteristics as modifiers of the area effect. Multilevel analysis also allows the simultaneous examination of within and between neighborhood variability in the outcomes, and the extent to which between-neighborhood variability is “explained” by individual-level and neighborhood-level factors. Studies using these approaches have usually linked information on small area characteristics available in censuses to individual-level covariate and outcome data from surveys, epidemiological studies, or vital statistics data. For the most part, contextual and multilevel studies have been consistent in documenting “independent” associations of neighborhood socioeconomic characteristics with individual-level outcomes after controlling for individual-level socioeconomic position indicators. For example, living in a disadvantaged area appears to be associated with ill health, even after accounting for the personal income of persons living in different areas. However, the strength of the possible neighborhood or area effect is still under debate. Although contextual or multilevel studies are an attractive option in the investigation of neighborhood effects, their use raises a series of methodological challenges that are discussed in more detail below.

In contrast to the large-scale quantitative approaches summarized above, an alternative strategy has been to compare a small number of well-defined and purposely selected contrasting neighborhoods. These types of studies can incorporate knowledge on local history, sociology, and geography in defining neighborhoods. In addition, they may directly collect detailed information on neighborhood characteristics and health outcomes through combinations of quantitative and qualitative strategies. This approach has been used to document differences across neighborhoods in resources and services and relate these differences to differences in health behaviors. However, it is limited in the number and range of neighborhoods investigated and possibly in the generalizability of results. Its strength lies in the use of locally based definitions of neighborhoods (rather than administrative proxies) and in the feasibility of detailed assessment of a variety of neighborhood characteristics, which may help us understand the processes through which neighborhood environments could affect health.

#### CHALLENGES IN THE INVESTIGATION OF NEIGHBORHOOD HEALTH EFFECTS

A key challenge in the investigation of neighborhood health effects is specifying the specific processes through which neighborhood characteristics may affect health. This requires developing models of how features of residential areas may be related to specific health outcomes and empirically testing aspects of these models. In contrast to other fields, where the theory on the processes linking neighborhood characteristics to outcomes such as violence or child development have been well articulated, research on neighborhood health effects has only recently begun to articulate the processes that may explain the associations observed with health outcomes. The testing of aspects of these models also raises a series of important methodological challenges. Some of these challenges are specific to the investigation of neighborhood effects, and others pertain to the more general problem of the difficulties inherent in investigating complex causal processes using the quantitative methods usually used in public health and epidemiology. Analogous methodological challenges arise in research on “neighborhood effects” in fields other than health.

A first issue is the definition of *neighborhoods* or, perhaps more precisely, of the geographic area whose

characteristics may be relevant to the specific health outcome being studied. In health research, the terms *neighborhood* and *community* have often been used loosely to refer to a person's immediate residential environment. The more generic term *area* has also been used. Clear distinctions between the terms *neighborhood*, *community*, and *area* are usually not made. Administratively defined areas have been used as rough proxies for neighborhoods or communities in many studies. There are multiple possible definitions of neighborhoods. The criteria used to define neighborhoods can be historical and geographical, based on people's characteristics or perceptions, or based on administrative boundaries. Boundaries based on these different criteria will not necessarily overlap, and alternative definitions may be relevant for different research questions. For example, neighborhoods defined based on people's perceptions may be relevant when the neighborhood characteristics of interest relate to social interactions or social cohesion, administratively defined neighborhoods may be relevant when the hypothesized processes involve policies, and geographically defined neighborhoods may be relevant when features of the chemical or physical environment (e.g., toxic exposures) are hypothesized to be important. More generally, the size and definition of the relevant geographic area may vary according to the processes through which the area effect is hypothesized to operate and the outcome being studied. Areas ranging from large to small with varying geographic definitions may be important for different health outcomes or for different mediating mechanisms. For some purposes, the relevant area may be the block on which a person resides, for others it may be the blocks around the residence, and for others it may be the geographic area in which services such as stores or other institutions are located. The size and definition of the area, the relevant processes, and the outcome being studied are linked. The development and testing of hypotheses regarding the precise geographic area that is relevant for a specific health outcome is a key challenge to neighborhood health effects research.

A second key issue is specifying (and measuring) the relevant area or neighborhood characteristics. To date, most existing research has examined how aggregate measures of neighborhood socioeconomic context are related to health outcomes. These associations are compatible with a wide range of processes relating neighborhood environments to

health. Establishing whether the associations observed reflect causal processes will require the direct empirical examination of the specific features of areas that may be related to different outcomes. The specification of these features is directly linked to theory on the processes hypothesized to be involved. The features of neighborhoods that are relevant are likely to differ from health outcome to health outcome but may include both material (physical or infrastructure) and social attributes. Material features may include, for example, availability of parks and recreational resources, density of fast-food stores, and toxic exposures. Social features may include social cohesion and social norms and values, which may, for example, influence the adoption of behaviors. In their proposed framework for conceptualizing, operationalizing, and measuring neighborhood effects on health, MacIntyre, Ellaway, and Cummins (2002) have referred to these two broad domains as features of material infrastructure and features of collective social functioning. To date, however, few studies have examined specific features of areas as predictors of health.

From a methodological point of view, examining the role of specific neighborhood or area characteristics is complex, because many of these dimensions may be interrelated (and thus difficult to tease apart) and may also influence each other. For example, features of the physical environments of neighborhoods may influence the types of social interactions, and vice versa. In addition, the processes involved, and the relevant neighborhood attributes, may differ from one outcome to another. For example, mechanisms involving resources and the physical environment may be more relevant for some outcomes (e.g., physical activity), whereas those involving social norms or contagion processes may be more important for others (e.g., smoking).

From the operational point of view, the measurement of specific characteristics of neighborhoods is complex. Options for the collection of this type of information include surveys of residents (which may be aggregated up to the desired area level) on objective and subjective characteristics of their neighborhoods, direct observation or videotaping and ranking of neighborhoods on prespecified criteria by raters (systematic social observation), and linking databases with geographically linked information (e.g., from public agencies) and estimating density and distance measures. The assessment of neighborhoods or areas

presents a series of methodological challenges related to the measurement of ecological settings.

A crucial problem in the examination of neighborhood effects is how individual-level characteristics should be incorporated into the conceptual models and included in the analyses. The most common criticism of neighborhood effects is that they result from confounding by individual-level variables, that is, that differences across neighborhoods are not due to the effects of neighborhoods per se but rather to differences in the types of people living in different neighborhoods. The selection problem is a variant of this issue: People may be sorted into neighborhoods based on individual characteristics, and it may be these individual characteristics rather than neighborhood attributes that are related to health. The ideal solution to this problem is the use of experiments or randomized trials. Although some randomized trials of changes in neighborhood contexts have included health measures as outcomes, the vast majority of work remains observational. As a way to respond to the confounding and selection problem, observational studies have attempted to control for individual-level variables, most commonly indicators of social position, in order to determine whether associations are “independent” of individual-level attributes. Although this approach has served to revitalize interest in neighborhood health effects, it has several limitations in terms of estimating true causal effects of neighborhoods on health. To the extent that neighborhoods influence the life chances of individuals, neighborhood social and economic characteristics may be related to health through their effects on the achieved income, education, and occupation of their residents, making these individual-level characteristics mediators (at least in part) of neighborhood health effects rather than confounders. In addition, because socioeconomic position is one of the dimensions along which residential segregation occurs, living in disadvantaged neighborhoods may be one of the mechanisms leading to adverse health outcomes in persons of low socioeconomic position. For these reasons, although teasing apart the “independent” effects of both dimensions may be useful as part of the analytic process, it is also artificial.

Because disease is expressed in individuals, neighborhood factors necessarily exert their effect through individual-level processes, including behaviors and biological precursors of disease. For example, if neighborhood environments are related to cardiovascular

risk, they may exert their effects by influencing the behaviors of individuals. This raises questions regarding what individual-level variables should be controlled for in estimating neighborhood effects. Moreover, recent work has highlighted the limitations of multivariate adjustment strategies in estimating “independent” effects in situations (like the investigation of neighborhood effects) involving complex causal chains and numerous confounders and mediators. Further complexity results from the fact that in some cases, neighborhood and individual characteristics may mutually influence each other. For example, the availability of healthy foods in a neighborhood may influence the dietary behaviors of individuals, and individual behaviors may in turn affect food availability. In other words, individual properties may themselves shape neighborhood attributes. Understanding area or neighborhood effects may require the testing of hypotheses involving dynamic and reciprocal relations like these. The multivariate adjustment methods usually used in epidemiology (and used in the vast majority of neighborhood effects studies to date) are not well suited to the identification of causal neighborhood effects in these situations.

In addition to being mediators or confounders of neighborhood effects, it is likely that individual-level characteristics interact with neighborhood properties in shaping health outcomes. For example, gradients by individual-level income may be stronger in poor neighborhoods (where those with low income are unable to gain access to resources outside the neighborhood) than in rich neighborhoods (where the comparative advantage conferred by high income is not as great). Although a few studies have investigated interactions between neighborhood socioeconomic characteristics and individual-level social class indicators, results have not been fully consistent regarding the types of interactions present. The investigation of interactions requires large data sets and is precluded if correlations between neighborhood and individual-level variables are very high. Nevertheless, the development and testing of specific hypotheses regarding interactions may help enhance understanding of the processes through which neighborhood contexts may affect health.

Both cross-sectional and longitudinal study designs have been used to examine associations between neighborhood characteristics and health. Although several longitudinal studies have neighborhood differences in mortality or incidence of disease, most

research has relied on the measurement of neighborhood environments at one point in time. Persons change neighborhoods over their life course, and neighborhoods themselves may also change over time. The cumulative or interacting effects of neighborhood environments measured at different times over the life course, the effects of duration of exposure to certain neighborhood conditions, the effects of changes over time in neighborhood characteristics, and the impact of moving from one neighborhood to another have not been systematically examined. The investigation of these longitudinal and life course dimensions will require study designs that follow both individuals and neighborhoods over time. More generally, there has been relatively little attention in existing research to the time scale over which any neighborhood effects are hypothesized to operate. Whereas for some health outcomes neighborhood characteristics measured simultaneously with the outcome may be relevant (e.g., availability of recreational spaces at a given point in time may be related to individuals' physical activity at the same point in time), for others longer time lags may be involved.

There has also been growing interest in increasing the use of experimental study designs in the investigation of neighborhood effects. One option is the inclusion of health outcome measures in randomized intervention studies, where, for example, families from disadvantaged neighborhoods are randomly assigned to move to low poverty areas. The randomization avoids the limitations (predominantly related to selection problems) inherent in observational studies. This approach, however, does not allow identification of the specific features of neighborhoods that are relevant, and also has limitations stemming from participation rates and dropouts.

Combinations of quantitative and qualitative research approaches may be especially useful in research on neighborhood health effects. There is a long history of ethnographic studies of how neighborhoods influence individuals within them. Qualitative studies may be helpful in understanding the processes involved as well as the dynamic interactions between area and individual characteristics, which may be difficult or impossible to examine using purely quantitative approaches. The combination of smaller-scale, in-depth approaches (qualitative and quantitative) focusing on a few contrasting neighborhoods with large-scale analyses of routinely available quantitative data on a large sample spanning a broader range of neighborhoods is a promising area.

An additional issue that has yet to be fully explored in research on neighborhood effects pertains to spatial dependencies across neighborhoods themselves. Aside from the need to account for these spatial dependencies in studies of neighborhood effects, investigation and quantification of these spatial dependencies may itself be of interest in terms of understanding the role of place in health. Just as individuals are interacting and interdependent parts of social groups, neighborhoods (as well as other geographically defined areas) are interdependent and interacting parts within larger wholes. For example, neighborhoods may play different roles within the social and economic structure of a city, and health-related differences across neighborhoods may be partly shaped by how neighborhoods relate to each other within the larger city structure. Only recently have these spatial processes begun to be directly investigated in neighborhood effects research, and applications to health outcomes remain rare. The presence of multiple levels as well as the roles of dynamic interactions within and between levels is a challenge in the investigation of neighborhood effects as it is for epidemiology generally.

The recent surge in neighborhood effects research in health has been fruitful in that it has stimulated thinking on the ways in which social processes (in this case the patterning of social and physical attributes across space) may influence health. Nevertheless, empirical research in this field remains plagued by complexities that make it difficult to definitively conclude from existing work whether neighborhood contexts are indeed causally related to health, and if so, what the mediating processes may be. Current research efforts focus on studies specially designed to test hypotheses regarding the specific processes through which neighborhood or area effects may affect specific health outcomes, and the time scale over which these effects may operate.

—Ana V. Diez Roux

*See also* ECOLOGICAL MODELS: APPLICATIONS TO PHYSICAL ACTIVITY; ECOSOCIAL THEORY; SOCIOECONOMIC STATUS AND HEALTH

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have increased appetite, diminished likelihood of being physically active, or metabolic differences in the way the body handles both calories consumed and expended.

Despite evidence of a strong genetic component in determining weight, the specific genes that influence body weight or predisposition to weight gain are not well known. One gene of interest, the *ob* gene, encodes a protein hormone called leptin. Higher concentrations of leptin are found in overweight individuals and increase proportionally with body fat. Leptin secretion leads to activation in brain areas involved in regulation of food intake and energy balance. Research on leptin as a body weight regulator is ongoing, but early studies have shown that some individuals injected with leptin serum lose weight, suggesting that some obese individuals may have developed leptin resistance, much like diabetics develop insulin resistance.

### Environment

While genetics helps address obesity at an individual level, large population increases in obesity are explained by the environment. Many studies show that obesity rates in countries rise with modernization. This societal increase is a reflection of the “toxic food environment” in which Americans live.

In the United States, high-sugar, high-fat, and hence high-calorie junk food is affordable and convenient, and portion sizes are growing. The 8-ounce soft drinks of 50 years ago are now 16-ounce or 20-ounce bottles. Fast food chains promote larger-size “value meals” that can fulfill, in one meal, almost one entire day’s recommended calorie intake. Children are often the targets of junk food promotion. More than 5,000 schools in the United States have contracts with fast food agencies to have outlets in the cafeterias. In addition, the average child watches 10,000 food advertisements on television each year, the majority of which are advertisements for sugared cereals, candy, fast foods, and soft drinks.

Compounding the problem of increasing energy expenditure is the increasing sedentary nature of modern societies. The Office of the Surgeon General’s report on activity and health found that more than 60% of Americans do not obtain regular physical activity and 25% get no activity at all. The Centers for Disease Control and Prevention and the American College of Sports Medicine recommend 30 minutes of

moderate activity three to five times per week. The population is far from this.

### HEALTH RISK FACTORS

Approximately 280,000 deaths are attributable to obesity each year in the United States alone. Excess body weight is associated with a number of risk factors for coronary heart disease, such as hypertension, hyperglycemia, increases in low-density lipoprotein (LDL) and triglyceride levels, and decreases in high-density lipoprotein (HDL). These risk factors increase the likelihood of stroke, heart disease, and death. Distribution of fat also appears to affect health risks; excess upper-body fat is associated with hypertension, diabetes, and other medical problems.

#### Disease

Weight gains of more than 10 kg are associated with elevated incidence of hypertension and coronary heart disease. Risk of Type 2 diabetes increases even with weight gains of 5 kg between age 18 and midlife. Risk for developing endometrial and gallbladder cancer and gallstones are several times higher in obese individuals compared to average-weight individuals. Gallbladder disease among women in the highest BMI quartile is almost 3 times as high as women in the lowest, and twice as high among men. Osteoarthritis of the knees and hips are also strongly associated with body weight, but overweight women are less likely to become subject to hip fractures and breast cancer. Even modest weight loss of 5% to 15% is associated with improvements in blood pressure, lipids, and insulin sensitivity.

### WELL-BEING

#### Psychological Effects and Consequences

Because of relentless social pressure to be thin, strong bias against overweight individuals exists, and hence many obese individuals suffer from guilt and shame. Research on whether obese individuals have more psychopathology overall is mixed. Most studies comparing obese and nonobese groups on psychological variables such as depression and anxiety have not found consistent differences; thus, it appears that not all obese individuals suffer psychological distress from their obesity. Body image dissatisfaction has

been found to be consistently high in obese individuals, especially in adolescent girls and college-age women, which may increase the risks of habitual dieting or developing an eating disorder. It is probably the case that some obese individuals endure considerable distress and others do not, hence it is important to find what makes some more vulnerable than others.

### Social Effects and Consequences

Obesity also has social and economic consequences. Direct health care costs attributable to obesity in 1995 were estimated at \$51.6 billion, almost 6% of the total health care expenditure for that year. Physician visits attributable to obesity nearly doubled between 1988 and 1994, to 81.2 million visits per year. Using health care claims, obese employees had 21.4% more health care expenditures than lean employees, an increase comparable to risk factors such as smoking, high blood pressure, and high alcohol intake.

There are indirect costs attributable to obesity as well. In 1994, obese persons lost 39.2 million workdays; the lost productivity is estimated at around \$3.93 billion. High-level absenteeism (seven or more absences due to illness during the previous 6 months) is twice as high among obese employees as average-weight employees, and moderate absenteeism (three to six absences) is 1.49 times as likely. In 1994, 5.9% of men and 4.7% of women with a healthy body weight were unable to work, compared to 5.6% and 7.9%, respectively, in the overweight population, and 9.6% and 12.6% in the obese population.

In addition to economic consequences of the condition, overweight individuals are less likely to get married and complete less schooling than average-weight individuals. In children, being overweight is associated with problems with peers, the consequences of which may extend far into the future.

One important factor in understanding the psychosocial consequences of obesity is the existence of bias and discrimination. Obese individuals are stereotyped as stupid and lazy, and they experience discrimination in many domains of life, including at school, with employment and promotions, and in medical settings. Negative attitudes about weight are conveyed through magazines, television, and everyday conversation; obesity is seen as a controllable condition and therefore overweight people deserve blame and scorn.

### CONCLUSION

Obesity is an ever-increasing problem. Excess body weight brings greatly increased risk for medical and psychosocial problems. Body weight is partially determined by genetics, but the environment has a strong relationship with weight and might be improved by decreasing consumption of high-calorie foods and increasing physical activity. Research pertaining to the psychopathology of obese individuals is not uniform, but there is clearly psychological distress in a subset of the obese. Acceptance of overweight individuals may lead to less psychological distress and minimize some of the psychosocial effects of obesity.

—Shirley S. Wang and  
Kelly D. Brownell

See also OBESITY IN CHILDREN: PHYSICAL ACTIVITY AND  
NUTRITIONAL APPROACHES; OBESITY IN CHILDREN:  
PREVENTION; OBESITY: PREVENTION AND TREATMENT

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## OBESITY IN CHILDREN: PHYSICAL ACTIVITY AND NUTRITIONAL APPROACHES

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Obesity in youths has increased to epidemic proportions in the last two decades. This poses a serious



health hazard. Obesity is often the precursor to other diseases, such as Type 2 diabetes and hypertension, that can lead to cardiovascular disease (CVD) in adulthood, and some of these complications emerge during the childhood and adolescent years. It is therefore imperative to intervene in childhood in order to retard or negate the appearance of obesity and CVD risk factors such as high levels of insulin, glucose, cholesterol, triacylglycerol, and blood pressure.

Decreased energy expenditure and increased energy intake are two of the major lifestyle behaviors thought to play a role in the development of obesity and consequent CVD. Decreases in moderate and vigorous physical activity (PA) and increases in sedentary activities such as television viewing, video game playing, and computer use have been associated with decreased energy expenditure. Other potential contributing factors are decreases in time spent in physical education at school, and the perception that neighborhoods may be unsafe for children to play in unsupervised. The increased availability and consumption of fast food, soft drinks, and other high-sugar or high-calorie foods and beverages are also thought to be contributors to the obesity epidemic. There are several possible settings for interventions targeting PA and nutrition in youths, including school, home, community, and medical offices. The focus here is on PA and nutrition interventions conducted in nonmedical settings.

Two of the important time periods that can be targeted with PA interventions in children and adolescents are during school and immediately after school. The small number of studies that have used interventions targeting health education and/or physical education classes have yielded mixed results. Some of the studies that measured adiposity using either body mass index or skin folds reported significant decreases in adiposity in youths who were exposed to an intervention compared to controls, while most reported no significant differences between the two groups. One study that had a comprehensive 2-year school-based intervention found a decrease in the prevalence of obesity and an increase in obesity remission in girls but not boys, and a decrease in television viewing in girls and boys. Another comprehensive 2-year study in middle schools found a decrease in adiposity in boys but not girls. Few studies have measured the effect of the intervention on CVD risk factors. Some studies found beneficial effects on blood pressure, total cholesterol (TC), high-density

lipoprotein cholesterol (HDL), and TC/HDL. In some cases, these changes were gender specific. Other studies found no significant effect of the intervention on lipids, cholesterol, or insulin and glucose. The disparities in the results may be due to several factors, including (a) whether the intervention occurred in the classroom, during physical education, or both, (b) the length of the intervention (i.e., 8 weeks to 3 years), (c) the age range of the subjects, and (d) the actual content of the intervention.

Fewer studies still have been conducted in the after-school time period, when youths are likely to engage in sedentary activities such as television viewing while consuming high-calorie, high-fat snacks. In one study, 79 obese 7- to 11-year-olds were randomized to either (a) a group that engaged in PA for the first 4-month period and then ceased PA for the next 4 months or (b) a group that served as a control for the first 4 months and then engaged in PA for the next 4 months. The goal of this study was to investigate the effect of PA on body composition (primarily adiposity), CV fitness, CV risk factors, and free-living diet and PA. Compared with the 4-month periods of no-PA, favorable changes were seen during the 4-month periods of PA in percentage of body fat, vigorous PA, insulin, and triacylglycerol. In another study, 81 obese 13- to 16-year-olds were randomized to one of three groups: (1) lifestyle education (LSE) sessions only, (2) LSE plus moderate-intensity PA, or (3) LSE plus vigorous PA; the energy expenditure for the two PA groups was controlled by having the moderate-intensity group exercise longer each session. The PA reduced percentage of body fat, although there was no clear effect of intensity. Favorable changes were seen in triacylglycerol, TC/HDL, and diastolic blood pressure. In a study without a control group, 12 weeks of PA after school resulted in decreased adiposity in obese 11- to 14-year-old African American and Hispanic girls. The results of these studies indicate that controlled PA interventions held in the after-school hours can favorably impact adiposity and CVD risk factors in youths.

Nutrition interventions have targeted two school settings: providing nutrition information in the classroom and modifying the food items and choices offered by the school. Most studies that modified the foods offered by the school found decreases in fat intake during school lunch and decreased energy intake and increased fruit and vegetable intake as measured by 24-hour recalls. One 2-year study found

no effect on fat intake. Studies that provided nutrition education found beneficial changes, including decreased intake of foods high in cholesterol and fat, decreased fat intake, increased fiber intake, increased fruit and vegetable intake, and choosing healthier snacks.

Studies whose goal it is to change both youths' PA and nutrition behaviors are hard to implement successfully, and even then can yield varying results. Outcome measures are often limited to the actual behaviors, that is, fat intake or time spent doing PA, and may sometimes include measures of adiposity. Few studies have measured actual CVD risk factors, which may incur beneficial changes even in the absence of changes in adiposity. Therefore, interventions need to be designed and tested that are comprehensive in nature. Furthermore, in order to measure the impact of these interventions on CVD risk, outcome measures also need to be comprehensive, including adiposity and several CVD risk factors.

—Paule Barbeau

See also OBESITY: CAUSES AND CONSEQUENCES; OBESITY IN CHILDREN: PREVENTION; OBESITY: PREVENTION AND TREATMENT; SCHOOL-BASED HEALTH PROMOTION

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## OBESITY IN CHILDREN: PREVENTION

Obesity among children and youth, sometimes called overweight, is typically defined as a body mass index (calculated by dividing weight by height squared, and expressed as kg/m<sup>2</sup>) greater than or equal to the 95th percentile for children of the same age and gender. The prevalence of obesity among children and youth increased rapidly in the United States and other industrialized countries during the period 1970 to 2000. Obesity rates are also rising among children in less industrialized countries and among adults globally. Although the causes of obesity include both genetic and environmental determinants, obesity ultimately results from an excess of energy intake via diet relative to energy expenditure via physical activity. Both energy intake and expenditure can be influenced by individuals and their social and physical environment, and hence are the foci for action to prevent or treat obesity.

Obesity during adolescence is the best single predictor of adult obesity, although this relationship is not strong for early childhood obesity. Some studies also indicate prenatal risks. Efforts to prevent obesity and reduce obesity risk among children and youth are thus particularly important, and are focused on factors that affect food intake and physical activity in household, school, and community environments.

Coincident with the increase in obesity among children and youth in recent decades has been a tremendous increase in the availability of foods for consumption and in advertising directed at children to promote consumption. There is consistent evidence for increasing inactivity in children's and adolescents' lives during this time, particularly increasing television viewing. Television viewing has been related to

this increasing prevalence in multiple longitudinal and cross-sectional observational studies. This effect is most likely due to both the displacement of more vigorous activities by television and effects on diet. Foods are the most heavily advertised product on children's television, and television viewing time is associated with between-meal snacking. Both clinical and school-based randomized trials have demonstrated that reduction in time spent watching television reduces obesity. Television viewing reduction is thus one realistic target for preventive efforts in households.

Another opportunity for prevention includes anticipatory guidance counseling for parents from primary health care providers focused on potential sources of excess caloric intake, such as sugar-sweetened beverages and super-sized foods, as well as reductions in time spent watching television.

School-based programs represent an important channel for behavioral change because of near universal enrollment and the potential to affect behaviors of children that track into adolescence and adulthood. Coordinated school health programming can potentially impact student diet and activity levels via altering school-based curricula, activities, and environments. Randomized trials indicate the success of school curricula in improving diet, reducing television viewing, and reducing obesity.

Because 15% of children and youth are now overweight or obese, prevention of adult obesity needs to include treatment of children and youth. However, the only interventions that have shown long-term effectiveness in reducing obesity have been intensive clinical programs for obese children. These are intensive programs that require parental participation, professional staff, and focus on modifications in both diet and physical activity levels.

—Steven L. Gortmaker

See also OBESITY: CAUSES AND CONSEQUENCES; OBESITY IN CHILDREN: PHYSICAL ACTIVITY AND NUTRITIONAL APPROACHES; OBESITY: PREVENTION AND TREATMENT

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## OBESITY: PREVENTION AND TREATMENT

Obesity is a condition characterized by elevated fat mass. It is typically estimated by the body mass index (BMI; kg/m<sup>2</sup>), which is highly correlated with measures of body fat. The World Health Organization (WHO) defines the desirable range as a BMI between 18.5 and 24.9, *overweight* as a BMI of 25 to 29.9, *obese* as a BMI of 30 or greater, and *morbidly obese* as a BMI of 40 or greater. These categories have been established to reflect physical health risks associated with increasing BMI.

Obesity increases risk for cardiovascular disease, diabetes, hypertension, stroke, gallbladder disease, respiratory disease, some kinds of cancer, and more. Risk is determined in part by the distribution of fat on the body, with intraabdominal adiposity putting individuals at greatest risk. Risk for increased mental health difficulties does not appear to increase with BMI. As a group, the obese do not experience greater psychiatric symptoms than their nonobese counterparts, although the subgroup of individuals who seek professional weight reduction treatment are more likely to report depression, anxiety, and binge eating.

By 1999, rates of obesity in the United States reached 27%, with an additional 34% of individuals meeting criteria for overweight. These figures represent a dramatic increase over the previous decade, with a particularly steep increase in children and adolescents. Obesity has become the single most expensive health problem in the United States, surpassing smoking and alcohol in its medical and financial impact; in 1995, obesity-related complications were estimated to cost the United States \$99 billion. Furthermore, the stigma associated with obesity affects the quality of life of obese persons. Obese women are less likely to complete high school, less likely to marry, and have lower household incomes. Overweight individuals are subjected to prejudice and discrimination when seeking college admissions, employment, and housing.

The etiology of obesity is simultaneously simple and complicated. Simply, one gains weight when taking in more calories than are expended. How this imbalance comes about, however, represents the confluence of biological, psychological, and environmental factors. Between 25% and 40% of an individual's weight is genetically determined through the mechanisms of fat cell number, basal metabolic rate, weight gain in response to overfeeding, and other factors. The remainder is accounted for by an individual's behavior and its interactions with biology and an environment increasingly supportive of weight gain. Longitudinal research has shown that individuals who move from less modernized to more modernized countries gain weight. The latter environment is one in which individuals are constantly exposed to energy-dense, heavily advertised, inexpensive foods, and in which a more sedentary lifestyle is supported—what Kelly Brownell and colleagues refer to as the “toxic environment.”

Demographic risk factors for obesity include age, gender (being female), ethnic minority status, lower socioeconomic status, and having a family history of obesity.

## TREATMENT

### Goals of Treatment

Most weight loss approaches will produce some initial weight loss, and some will produce significant loss. However, the data consistently show that few individuals will achieve long-term maintenance of significant weight loss. Thus, treatment goals of reaching the “ideal weight” have been replaced with goals of a loss of 5% to 15% of body weight, a figure associated with significant improvements in a variety of health indices. Furthermore, increasing physical activity and improving diet improve health indices independent of weight loss. Goals of modest weight loss, healthier eating, and increased activity are recommended.

### Treatment Matching

Treatment matching is a strategy for selecting an appropriate level of treatment based on a patient's risk profile. Less intensive and expensive approaches are recommended for individuals with lower BMIs, such that for lowest risk persons a program of prevention of weight gain through self-directed efforts and/or

primary care support may suffice. The more aggressive and expensive treatments, such as pharmacological approaches or bariatric surgery, are recommended for individuals with BMIs of  $> 30$  and  $> 40$  respectively. The more aggressive approaches carry with them greater risk of more serious side effects, and only in very overweight individuals is the potential benefit of decreased risk of obesity-related health problems deemed to outweigh the risk of these side effects. For all patients, less aggressive approaches should be tried before more aggressive ones are resorted to.

### Self-Help and Commercial Programs

There exist very little data on commercial weight loss programs. Weight Watchers has reported a recent average loss of 5 kg in 6 months among its group members, and substantial and maintained losses have been reported for the Trevoze Weight Loss Program. While these particular programs are inexpensive (Trevoze is free and Weight Watchers charges \$12/meeting), most others are not so and provide no data on efficacy. There exist virtually no data on the efficacy of self-help programs promoted through popular diet books, which are purchased by millions each year. Data are sorely needed before recommendations can be made with respect to these treatments.

### Behavioral Treatments

Most professionally directed behavioral weight loss programs operate in academic settings and are therefore well researched. They typically include dietary restriction (1200-1500 kcal/day), behavioral strategies to help limit intake (particularly of energy-dense foods) such as self-monitoring, portion control, and stimulus control. Many programs also include a focus on increased activity.

A 20-week program induces an average loss of 9 kg, approximately 9% of initial weight. Without further treatment, patients regain one third of lost weight in the year following treatment, with increasing regain over subsequent years. With further follow-up support, maintenance improves. Longer treatment does produce greater weight loss, although the rate of loss slows with time. Physical activity, whether through structured exercise periods or exercise incorporated into one's lifestyle, is associated with superior maintenance of weight loss. Very low-calorie diets

(400-800 kcal/day) produce a more dramatic initial weight loss, but these patients regain more rapidly than those on the more traditional regimen. It should be noted that most research on these programs has included predominantly Caucasian samples, a problematic state of affairs, given the high rates of obesity in ethnic minority populations in the United States.

It is notable that family-based behavioral weight loss treatments for obese children *do* produce significant and enduring results: One review revealed that, at 10-year follow-up, nearly 30% of children were no longer obese. These interventions include a diet and physical activity component, behavioral strategies such as self-monitoring, stimulus control, and positive reinforcement, and typically require active participation on the part of at least one parent through parental modeling of appropriate eating and activity behaviors. Behavioral interventions for adolescents are less successful, likely due to less parental control over the adolescent's behavior, suggesting the urgency of addressing obesity in its early stages.

### Pharmacological Treatments

The realization that obesity is a chronic condition suggests the use of long-term pharmacological treatments. Currently, two medications are FDA approved for the long-term treatment of obesity. Sibutramine (Meridia) is a serotonin-norepinephrine reuptake inhibitor that appears to act on receptors in the hypothalamus that control satiety. Sibutramine is associated with increased heart rate and blood pressure and is contraindicated for individuals with hypertension and cardiovascular disease. Orlistat (Xenical) is a lipase inhibitor that produces weight loss by blocking the absorption of about one third of the fat a person consumes. The blocked fat is excreted from the body through stool, resulting in an overall reduction in calorie absorption. Consuming high-fat meals while taking this medication leads to unpleasant side effects that include oily stool and fecal incontinence; thus patients are reinforced for adhering to a low-fat diet. Both medications produce losses of 7% to 15% of initial weight, with greater losses achieved when the medications are combined with behavioral programs.

When obesity is accompanied by binge eating, selective serotonin reuptake inhibitor (SSRI) antidepressants (e.g., Prozac, Zoloft, Paxil) have produced decreases in binge eating and thereby some weight loss.

### Surgical Treatments

Given the risks associated with surgery in general, and surgery in obese individuals in particular, surgical treatments are recommended only for individuals with a BMI of 40 or greater or those with a BMI of 35 *and* additional health risk factors. Two types of procedures are in current practice: gastric restrictive procedures and combined gastric restriction and malabsorption. The former includes vertical banded gastroplasty (VBG) and gastric banding. VBG involves the creation of a small gastric pouch at the base of the esophagus to limit possible intake. VBG produces initial average weight losses of 25% of initial body weight at 18 months. In gastric banding, the gastric reservoir is achieved through laparoscopic surgery by the application of a small belt below the esophagus; the size of the reservoir may be adjusted in an outpatient setting to suit patient needs. Reported weight losses associated with gastric banding reach up to 55% to 65% at 3-year follow-up.

Combined restriction and malabsorption procedures include the gastric bypass, the biliopancreatic diversion, and the duodenal switch. In the gastric bypass procedure, the pouch is created as in VBG, but the stomach and part of the intestine are bypassed by attaching the pouch to the jejunum. This procedure has produced average weight losses of 30% of initial weight during the first 18 months, with maintenance of a 25% loss up to 14 years later. The biliopancreatic and duodenal procedures are less common due to greater side effect profiles; they involve gastric resectioning and cholecystectomy and a lengthier bypass, and thus variations of malnutrition occur in a substantial minority of patients. Extensive evaluations generally precede surgery for the purpose of identifying contraindications and preparing the individual for the ensuing changes.

Over the years, significant advances have been made in surgical techniques and in the care of patients postsurgery; hence the risk of surgery has declined. The large weight losses are associated with dramatic improvements in health. Surgery for obesity can be life saving.

### PREVENTION

Given the difficulty in treating obesity, prevention is the obvious alternative. Given the clear contribution of the environment to promoting weight gain, and the

challenge in changing individual behavior within this environment, more macrolevels of intervention would seem an appropriate target. There exist little data on the prevention of obesity. However, a heart disease prevention program in Finland provides some evidence that macrolevel programs can be effective in producing clinically meaningful change. Some areas of the country saw a more than 75% reduction in premature deaths related to heart disease and stroke over a 20-year period following combined efforts of government and professionals at the policy level. Policy initiatives included setting and enforcing nutritional standards for food served in schools and at public catering outlets without a consequent increase in meal prices, as well as initiatives aimed at increasing physical activity.

Thus, prevention efforts must include not only encouragement of the individual to make personal change, but an environment that supports that change. Recent suggested targets of policy initiatives include controlling advertising, particularly to children; controlling sales conditions, for example, limited distribution of high-calorie/low-nutrient foods in schools; controlling pricing such that high-calorie/low-nutrient foods are more expensive and the sale of healthy foods is subsidized; and enhancing opportunities for physical activity, especially in demographically higher-risk populations.

## CONCLUSION

The combination of prevalence, seriousness, and resistance to treatment make obesity one of the most significant public health problems of modern times. Advances have been made in treatment, but with the exception of surgery, weight losses tend to be modest and not well maintained. Prevention, therefore, must become top priority.

—Kathryn E. Henderson and  
Kelly D. Brownell

See also OBESITY: CAUSES AND CONSEQUENCES; OBESITY IN CHILDREN: PHYSICAL ACTIVITY AND NUTRITIONAL APPROACHES; OBESITY IN CHILDREN: PREVENTION

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## OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety is the field pertaining to the health and safety of the workforce. This field has been of societal concern since ancient times. The Edwin Smith Surgical Papyrus describes the treatment of injuries that were incurred by workers at the pyramid site in ancient Egypt (3000-2500 B.C.). Bernardino Ramazzini published the first Western textbook of occupational medicine in 1713. The pioneering work of Dr. Alice Hamilton in the 1920s served as a second of the initial steps toward the recognition of the field of Occupational Health and Safety in the United States.

Approximately 6,500 fatalities and 3,200,000 non-fatal injuries occur in the United States each year as a result of occupational injuries. In addition, there are about 862,200 occupational-related illnesses and 60,300 fatalities from occupational-related illnesses annually. Acute trauma is the leading cause of death and disability at work. Between 1980 and 1995, there were 16 deaths per day from trauma at work. Data from the National Institute for Occupational Safety and Health (NIOSH) reveal that \$171 billion is spent each year in direct and indirect costs of occupational injuries and illnesses.

Each workplace has its own unique challenges. Selected occupational groups with hazards specific to their employment include workers in the hospital

setting who are exposed to infectious agents such as hepatitis and HIV and to chemical hazards such as ethylene oxide. Firefighters face hazards such as smoke inhalation and medical sequelae thereof, and office workers face ergonomic hazards. According to the Bureau of Labor Statistics, the construction industry accounted for a greater proportion of fatalities than any other major industrial classification. In 1999, this industry accounted for 19.8% of the 6,023 occupational fatalities in the United States. Fatal falls accounted for 31.8% of the 119 fatalities. Selected occupational conditions of increased current concern are musculoskeletal disorders, exposure to poor indoor air quality, allergies, dermatitis, asthma, fertility and pregnancy abnormalities, hearing loss, infectious diseases, and violence and stress in the workplace. The modern workplace faces added stressors such as longer hours, shift work, compressed workweeks, and decreased job security.

Special populations such as the older worker, teen workers, and female workers may face hazards unique to their occupational group. According to the National Traumatic Occupational Fatalities data, workers aged 65 and older had a workplace fatality rate 2.6 times that of workers aged 16 to 64. Mining, agriculture, and construction saw the highest rates. Older men were at higher risk for fatalities caused by machines and older women for fatal falls and homicide. The number of older workers is projected to increase in the future. Young workers are also at risk; 70 teenagers die each year from work-related injuries in the United States, and 77,000 present to the emergency room with work-related injury. A study by NIOSH suggested that the three leading categories of work-related fatalities for 16- and 17-year-olds, namely, motor vehicle injuries, homicides, and machinery-related deaths, claim this age group at rates similar to or slightly higher than rates for adult workers.

It is projected that by the year 2008, women will represent 48% of the estimated 155 million workers. Compared to men, women appear to suffer disproportionately from some disorders. For example, musculoskeletal disorders account for 52% of injuries and illnesses suffered by female workers compared to 45% for men. In two thirds of the injuries resulting from workplace violence, the victims were women. Homicide, the leading cause of injury death in the workplace for women, accounts for 40% of these deaths. Hazards in the workplace may increase the risk of cancers unique to women, such as cervical and

breast cancer. Women disproportionately comprise personnel in the health care industry, as 92% of the 4.3 million nurses and nurses' aides are women, thus exposing women to hazards unique to the health care setting.

The occupational medicine physician, the safety professional, and the management all work together to help provide a safe work environment. The occupational medicine physician provides care to workers who sustain work-related injuries and illnesses, and is responsible for establishing surveillance programs and instituting preventive measures in an effort to help provide a safe work environment. Safety professionals are concerned with the prevention and control of work-related injuries, illnesses, and other harmful events resulting from work. They are trained to recognize that occupational injuries and illnesses can be anticipated and prevented. They educate managers, supervisors, and employees regarding hazards that can cause injuries or illness, thus empowering them to help devise preventive measures. Ensuring a safe workplace cannot be accomplished without support from top management, however. In an effort to support occupational safety and health, management institutes preventive programs and provides occupational medicine services and proper personal protective equipment to employees. In addition, management helps to foster a climate at work where occupational health and safety is made a priority. The American College of Occupational and Environmental Medicine (ACOEM) is the nation's largest medical society dedicated to promoting the health of the worker. It was founded in 1916 and represents more than 6,000 physicians and other health care professionals specializing in the field of occupational medicine. ACOEM provides educational activities to physicians and nurses interested in this field. Occupational medicine became a distinct specialty within the American Board of Preventive Medicine in 1954. Occupational medicine training programs exist for physicians, nurses, and safety professionals who choose this field. In 2002, there were 37 sponsored graduate medical training programs in occupational medicine.

In 1971, the Occupational Safety and Health Administration (OSHA) was created with the goal of reducing occupational hazards, promoting a safe and healthy culture, and maximizing its effectiveness and efficiency by strengthening its capabilities and infrastructure. OSHA provides training, information, and free workplace consultations to small businesses in

matters concerning occupational health and safety. NIOSH is the federal agency mandated to conduct research to prevent injuries and illnesses in the workplace. This agency has tracked occupational injuries, illnesses, hazards, and exposures since its creation by the Occupational Safety and Health Act in 1970. NIOSH complements important statistical or surveillance activities carried out by other federal agencies such as the Bureau of Labor Statistics and by the private sector. NIOSH also analyzes and interprets existing data, undertakes data collection efforts to fill gaps in surveillance, provides support to state agencies to conduct occupational surveillance and associated prevention efforts, funds and conducts research on surveillance methods, and works with federal, state, and private sector partners to improve occupational health surveillance. NIOSH helped to establish the National Occupational Research Agenda (NORA) in 1996. NORA provides a framework by which to guide occupational safety and health research for the occupational health and safety community.

The cost of occupational injury and illness is borne by every member of the society. It is estimated that the worker and family bear 30% in lost wages and lost overtime opportunities as well as medical expenses arising from undiagnosed work-related conditions, work-related conditions not compensated, and compensation not fully replacing wages. Other costs are associated with pain and suffering and loss of status and self-esteem to the worker and family. The employer is estimated to bear 40% of the cost in workers' compensation premiums, the impact on productivity, retraining, administrative expenses, loss of morale, and other intangible factors. The taxpayer, by way of the government, bears about 30% of the cost, inasmuch as the government provides support services and medical care for indigent, injured, or ill workers who were previously employed or who lack workers' compensation benefits.

In summary occupational health and safety affects every aspect of our society, every age group and every occupation. Occupational morbidity and mortality are important public health problems in the United States. There have been strides in this field, especially during the latter half of the 20th century. Since the establishment of OSHA in 1971, workplace deaths have decreased by 50% and occupational injury and illness rates decreased 40%, although U.S. employment doubled from 56 million workers at 3.5 million worksites to 111 million workers at 7 million sites. Occupational

health and safety needs to be an integral part of any organization's mission, values, and operational responsibilities and is a core need of every business. The field of occupational health and safety must continue to make strides in order to improve the quality of the lives of individuals and of society as a whole.

—Judith Green-McKenzie  
and Edward Emmett

See also CENTERS FOR DISEASE CONTROL AND PREVENTION;  
NATIONAL INSTITUTES OF HEALTH

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## OPTIMISM, PESSIMISM, AND HEALTH

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The concepts of optimism and pessimism concern people's expectations for the future. These concepts have ties both to centuries of folk wisdom and to a class of psychological theories of motivation, which as a group are called expectancy-value theories. These theories suggest how optimism and pessimism come to be reflected in people's behavior and emotions. These reflections, in turn, represent pathways by which this personality disposition may influence people's health.



A little theoretical background: Expectancy-value models begin with the idea that behavior is aimed at attaining desired goals. Without a valued goal, no action occurs. The other core concept is expectancies: confidence or doubt about attaining the goal. If a person lacks confidence, again there is no action. Only with sufficient confidence do people engage (and remain engaged) in goal-directed efforts. These ideas apply to specific values and focused confidence; they also apply to optimism and pessimism, in which the “confidence” is simply broader in scope.

From these principles come many predictions about optimists and pessimists. When confronting a challenge, optimists should display confidence and persistence, even if progress is difficult and slow. Pessimists should be more doubtful and hesitant. Adversity should exaggerate this difference. Optimists believe adversity can be handled successfully, pessimists anticipate disaster. This can lead to differences in efforts to take precautions, differences in actions relating to health risks, and differences in persistence in trying to overcome health threats.

Behavioral responses are important, but overt behavior is not the only response when people confront adversity. People also experience emotions in such situations. Difficulties elicit many feelings, reflecting both distress and challenge. The balance among such feelings differs between optimists and pessimists. Because optimists expect good outcomes, they are likely to experience a more positive mix of feelings. Because pessimists expect bad outcomes, they should experience more negative feelings—*anxiety, sadness, and despair*. A good deal of research has found evidence of such emotional differences.

## HEALTH-RELATED BEHAVIORS

There are several ways in which this personality dimension may relate to health. One pathway derives from the fact that some health problems arise directly as consequences of people’s behavior. That is, some actions themselves are health risks. For example, smoking is a health risk. So is unsafe sex, driving without a seat belt, and eating a high-fat diet. Yet some people engage in all of these behaviors, whereas others take better care of themselves and avoid risk behaviors. Why this difference? Perhaps one reason some people fail to take precautions is lack of confidence. That is, they may lack confidence that taking proper steps will produce better outcomes for

themselves. If this were so, optimists should engage in more health-protective behaviors, and fewer risky behaviors, than pessimists.

On the other hand, it might be argued that optimists will expect the best, no matter what they do. This may make them feel impervious to any danger stemming from risky behaviors. If this were so, optimists would be less likely to take precautions than pessimists. The existence of these two lines of argument, making opposite predictions, makes it clear how important research is. Without collecting evidence, we would never know which line of argument is closer to the truth.

Studies bearing on this question have been done, however, and most of the evidence favors the position that optimists engage in health-promoting actions more than pessimists. Some of this evidence comes from studies of people with no salient health concerns, and relates to general health-promoting actions such as eating well, taking vitamin supplements, getting adequate sleep, using sunscreen, and so on. Some of the evidence comes from patient samples, who do have particular health concerns. It has been found, for example, that optimists exert greater efforts in a cardiac rehabilitation program, exercising more and reducing body fat more than pessimists. There is also evidence from other studies that optimists exert greater efforts toward recovery from surgery.

These findings suggest that the first line of reasoning is more correct than the second. This, in turn, appears to tell us something about the nature of optimism. Specifically, optimists do not seem to have naïve faith that everything will work out well for them, even if they do nothing to help. Rather, they seem to accept the fact that they have a role in many outcomes and that they must take active steps to ensure that positive outcomes emerge. Optimism thus appears to be a positive force for active self-care and self-protection, provided opportunities to take such steps present themselves.

## GIVING UP AND HEALTH

There is a flip side to this picture of optimists as being more deeply involved than pessimists in the pursuit of desired goals. Specifically, the reduced efforts of pessimists confronting adversity sometimes slide all the way into giving up. This giving-up response itself can have adverse health consequences.

Several kinds of health-relevant behaviors seem to reflect a giving-up tendency. One of them is alcohol

consumption, which at high levels is a health risk. Excessive alcohol consumption is often seen as reflecting the giving up of efforts to deal with one's problems. If so, pessimists should be more vulnerable than optimists to alcohol abuse. Results from two studies fit this picture. In one, among women with a family history of alcoholism, pessimists were more likely than optimists to report drinking problems. Another study examined people who had already been treated for alcoholism and were now entering an after-care program. This study found that pessimists were more likely than optimists to drop out of the program and return to drinking. These two studies converge in showing that pessimists display a form of disengagement—alcohol consumption—more than optimists.

People can give up in many ways, of course. Alcohol dulls awareness of failures and problems. People can also turn their backs on their problems by distracting themselves. Even sleeping can help people escape from situations they prefer not to face. Sometimes, though, giving up is more complete. Sometimes people give up not just on specific goals, but on all the goals of their lives, by committing suicide. Several studies have found pessimism to be a key indicator of suicide risk. Although many people might not immediately think of suicide as a "health" outcome, it would be hard to argue against the idea that suicide interferes with good health.

#### POTENTIAL PHYSIOLOGICAL PATHWAYS

Another potential pathway by which optimism may relate to health is more complicated and less well mapped out than those described thus far. Experiences of intense distress, hopelessness, and giving up have physical concomitants; so do positive emotions and engagement in strenuous efforts. Many believe physiological responses such as these play roles in health outcomes. These responses might influence a person's likelihood of getting a disease in the first place, they might influence the progression of diseases, they might even influence mortality. Since the emotional and behavioral responses that induce the physical responses are themselves linked to optimism and pessimism, it seems likely that optimists and pessimists may differ in at least some of the physiological responses they experience when under stress.

There are two distinct issues here. The first is whether optimism relates to health events that are not plausibly accounted for by the sorts of behavioral

pathways discussed earlier. The second is what kind of pathway would account for the association. With respect to the first issue, evidence is accumulating that differences in optimism-pessimism relate to differences in health-related events. With respect to the second issue, there is less to say. Research on pathways is at an early stage, and much less is known.

Studies of relations between optimism and health parameters have examined several different health indicators. One rather simple one is blood pressure regulation. This study involved 3 days of monitoring of blood pressure during normal activities. Results indicated that pessimists were more likely to have elevations in blood pressure than optimists. This study should not be taken as clear evidence that pessimism leads to hypertension, but it does suggest that further examination of the issue is warranted.

Several studies have examined differences in well-being following medical procedures. For example, one study of coronary bypass surgery included measures of patients' progress through the surgery. Two kinds of indirect evidence suggested that pessimists fared more poorly than optimists even on the operating table. Specifically, pessimists were more likely to display two markers during surgery that are widely taken as indicants of myocardial infarction. Thus, pessimists may have been at greater physical risk during the bypass surgery itself. Subsequent research with bypass patients focused on a problem that often arises after major surgery: the need for the patient to be readmitted to the hospital because of a deterioration in condition. This study found that optimists were less likely to be rehospitalized, either for problems related to postsurgical infection or for problems related to the coronary artery disease.

The successful management of disease can be reflected in many ways. Another reflection is the process of disease progression and worsening, which can be either rapid or slow. Many chronic or incurable diseases produce a sequence of new symptoms over time. An example is HIV infection. HIV infection initially has no observable symptoms. Eventually, it produces a variety of symptoms that become increasingly debilitating.

Researchers have examined development of such symptoms in men who were HIV-positive but symptom-free, as a function of psychological variables related to pessimism. The men completed a measure of stoic or fatalistic preparation for the worst, an index that has been characterized by its developers as

reflecting disease-specific pessimism. In this sample of men, all of whom initially were symptom-free, pessimistic responses to this measure predicted earlier symptom onset.

These researchers also studied survival time among patients whose disease had already progressed to AIDS. By the end of the study, 82% of the men had died from complications related to the disease. Disease-specific pessimism was related to shorter survival times. It was as though individuals with this attitude were preparing to die, and death then came to them more quickly.

Another project bearing on issues of disease progression and mortality examined a sample of cancer patients whose cancer had returned after earlier treatment. All the patients had completed a measure of pessimism about the future. They were followed for 8 months. By then, approximately one third of them had died. Greater pessimism predicted shorter survival time.

One more study, conducted in Finland, examined the relationship between a sense of hopelessness about the future and mortality in a sample of over 2,000 middle-aged Finnish men who had been treated for cancer or heart attacks. Hopelessness was assessed by two items: "I feel that it is impossible to reach the goals I would like to strive for" and "The future seems for me to be hopeless, and I can't believe things are changing for the better." These men were followed for 6 years. Those who had reported higher degrees of hopelessness had greater disease-specific mortality—and all-cause mortality—than men with less hopelessness.

Why were pessimistic people in these various studies more vulnerable than people who were more optimistic? Why were pessimists more likely to end up back in the hospital after heart surgery? Why were pessimistic cancer and HIV patients quicker to progress toward death? The answers—the mediating processes—are not clear. Perhaps pessimists give up the struggle, and this leads to physical changes that permit infection and disease to gain a greater foothold. Perhaps something about remaining engaged in the fight keeps the defenses of the body hard at work. Speculations about potential mechanisms currently revolve around neuroendocrine and immune responses. At present, however, there is little solid knowledge about the mechanisms underlying these effects. What is known is only that optimism

works to people's physical benefit and pessimism to their detriment. Isolating the mechanisms underlying these effects is an important part of the agenda for the future.

—Charles S. Carver

See also EXPLANATORY STYLE AND PHYSICAL HEALTH;  
HAPPINESS AND HEALTH; HOPELESSNESS AND HEALTH;  
OPTIMISM AND PESSIMISM: MEASUREMENT

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## OPTIMISM AND PESSIMISM: MEASUREMENT

Research has shown that optimism and pessimism are important influences on emotional responses to health problems and health-related coping behavior. Optimism and pessimism have been defined differently—and therefore measured differently—by different researchers. Thus, there are a variety of measures available. By far the most commonly used measures are the Life Orientation Test (LOT) and the Attributional Style Questionnaire (ASQ), which measure two different kinds of optimism/pessimism. These measures are based on different theories, predict somewhat different kinds of behaviors and outcomes, and do not correlate strongly with each other—or with the many other types of optimism/pessimism that researchers have identified.

## THE LIFE ORIENTATION TEST

The LOT, developed by Michael F. Scheier and Charles S. Carver, is designed to measure “dispositional optimism.” Dispositional optimism refers to a general tendency to expect positive outcomes, as opposed to dispositional pessimism, which refers to a general tendency to expect negative outcomes. These tendencies are sometimes referred to as “traits,” or “generalized outcome expectancies.” Reported alpha coefficients (a statistical measure of the internal consistency) range from about 0.75 to about 0.88, which indicates that the items intercorrelate with each other enough to support the assumption that they are all getting at the same psychological construct. Scheier and Carver have also shown that their measure has “discriminant validity,” which means that it can be distinguished from measures of related constructs such as self-esteem and anxiety. As predicted, people who answer more optimistically on the LOT tend to use more active coping strategies and report fewer physical and psychological symptoms than people who answer less optimistically.

The original LOT included eight optimism/pessimism questions and four “fillers,” which are questions included to disguise the purpose of the questionnaire. Answers to filler questions are not included when a measure is scored. The eight optimism/pessimism items include four items worded positively (i.e., where higher numbers indicate more optimism) and four items worded negatively (i.e., where higher numbers indicate more pessimism). The items are worded as descriptive statements: for example, “I’m always optimistic about my future,” which is a positively worded item, or “I hardly ever expect things to go my way,” which is a negatively worded item. For each item, respondents indicate the extent to which the statement is true of them, on a scale from 0 (strongly disagree) to 4 (strongly agree). Most researchers using the LOT reverse score the negatively worded items and then add together the scores for all eight items to create a total optimism score. This scoring follows both Scheier and Carver’s original intentions, and the general assumption that optimism/pessimism is a *bipolar* dimension, with optimism at one end and pessimism at the other end. This implies that a lack of optimism is equivalent to the presence of pessimism, and the lack of pessimism is equivalent to the presence of optimism.

More recently, several researchers have argued that optimism/pessimism refers to two separate *unipolar* dimensions, instead of one bipolar dimension. They argue that the positively worded LOT items measure optimism (or a lack thereof), while the negatively worded items measure pessimism (or a lack thereof), *and* that these two dimensions are not highly correlated. People may score high (or medium or low) on optimism *and* high (or medium or low) on pessimism, so that one could be both highly optimistic *and* highly pessimistic, or neither optimistic *nor* pessimistic. Some studies have found that the presence of pessimism predicts different outcomes (e.g., higher ambulatory blood pressure) than the absence of optimism. The LOT (and its revised and extended forms, described below) can be scored to obtain either an overall optimism score, or separate optimism and pessimism scores, so researchers often use both scorings and compare the results. For separate optimism and pessimism scores, one sums the responses to the positive items to obtain an optimism score, and the responses to the negative items to obtain a pessimism score.

In 1994, Scheier and Carver revised the LOT by taking out two items that were too similar to questions used to assess coping. The revised scale (LOT-R) correlates very highly with the original LOT. In 1997, Edward C. Chang and his colleagues published an Extended Life Orientation Test (E-LOT), with six items assessing optimism and nine items assessing pessimism. The E-LOT correlates highly with the LOT, but the former has slightly better “psychometric properties,” which means that it has greater internal consistency and more clearly distinguishable relations to other measures.

## THE ATTRIBUTIONAL STYLE QUESTIONNAIRE

The Attributional Style Questionnaire (ASQ) has also been widely used by researchers. This measure follows from work by Martin E. P. Seligman, in which he and his colleagues explore how people understand the events that happen to them and how that understanding influences their coping and health. Most of their work has focused on vulnerability to depression in response to negative life events. They theorize that individuals who respond to negative events by attributing them to stable, global, and internal causes

are more likely to become depressed. Attributions are the causal explanations we give for events. *Stable* attributions refer to causes that are relatively immune to change over time (e.g., ability as opposed to effort). *Global* attributions are to causes that should influence many domains (e.g., being generally unlucky), as contrasted with more *specific* attributions (e.g., having a bad day). *Internal* attributions are to causes within the individual (e.g., skill or absence thereof), as opposed to *external* causes (e.g., a vindictive boss). When something bad happens, people who believe that something within them, something that is unlikely to change, and something that influences most aspects of their life has caused the event are likely to be debilitated or depressed as a result. Seligman calls this way of explaining negative events a “pessimistic attributional style” in contrast to an “optimistic attributional style,” where negative events are attributed to external, unstable, and specific causes. He and his colleagues use those terms interchangeably with pessimism and optimism respectively. Assessing attributional style is an indirect way of getting at an optimistic or pessimistic outlook.

The original ASQ presented respondents with six negative and six positive events and asked them to write down one major cause and provide ratings of stability, globality, and internality for each event. For stability, respondents are asked, “In the future, will this cause again be present?” For globality, they are asked, “Is this cause something that just affects this type of situation, or does it also influence other areas of your life?” For internality, they are asked, “Is the cause of this due to something about you or something about other people or circumstances?” All responses are on seven-point scales, and are generally summed to create a total pessimism score. Globality and stability tend to correlate with each other (and combined are sometimes referred to as hopelessness), while neither correlates very highly with internality.

The first ASQ was not very reliable. In 1988, Christopher Peterson and Paul Villanova introduced the Expanded Attributional Style Questionnaire (EASQ), which includes 24 negative events (e.g., “You go out on a date, and it goes badly”) and has greater internal consistency than the original ASQ. The EASQ correlates modestly with the LOT and LOT-R, which suggests that they are getting at somewhat different constructs. The EASQ also correlates moderately with the other major measure of attributional style developed by Peterson and his colleagues:

the Content Analysis of Verbatim Explanations (CAVE). CAVE is a method of analyzing written or spoken content (e.g., speeches, interviews) for attributional style. Events and attributions are identified in a text, and trained judges rate each attribution on stability, globality, and internality. There is also a version of the ASQ for children, though the meaning of attributions by young children is a matter of contention.

## OTHER OPTIMISM/PESSIMISM MEASURES

The Optimism-Pessimism Instrument (OP), developed by William N. Dember and his colleagues, is another self-report measure that generates separate optimism and pessimism scores. The OP contains 18 positive items, 18 negative items, and 20 filler items, to which respondents indicate their agreement (strongly agree, agree, disagree, strongly disagree). Both O and P scores from the OP correlate moderately to strongly with the LOT and moderately with the ASQ. The OP is designed to measure positive and negative outlooks in a very broad way and contains many items that tap into constructs other than optimism and pessimism specifically.

Neil D. Weinstein developed a measure of “unrealistic optimism.” Respondents indicate the likelihood, relative to similar others, of negative and positive events happening to them in the future. Those who are unrealistically optimistic—that is, who think positive events are more likely and negative events less likely to happen to them than to others—may engage in risky health-related behavior. His measure is moderately related to other measures of optimism.

Julie K. Norem and her colleagues have developed the Defensive Pessimism Questionnaire (DPQ), which is designed to measure domain-specific optimistic and defensively pessimistic strategies. Seventeen items, which respondents rate according to how true they are for them, measure two components of defensive pessimism: negative expectations and reflectivity. Reflectivity refers to how much people mentally rehearse what might happen before an event. Those who score high in both pessimism and reflectivity tend to use defensive pessimism to cope with anxiety. Those who score low on both dimensions use strategic optimism, which involves setting high expectations and distracting oneself before an event. Both groups tend to perform better than other anxious people or dispositional pessimists. The DPQ correlates moderately with the LOT and E-LOT and weakly with the ASQ. It is designed to

tap into strategies that are specific to particular domains; thus, academic, social, recreational, and health versions of the scale have been used in research.

The Optimism-Pessimism Test Instrument (OPTI), developed by Deborah J. Stipek, Michael E. Lamb, and Edward F. Zigler, consists of 20 short stories, each of which is read by the tester. The child being tested is then asked to choose between a positive outcome or a negative outcome to the story. The total number of positive outcomes chosen is the optimism score.

—Julie K. Norem

See also EXPLANATORY STYLE AND PHYSICAL HEALTH;  
HAPPINESS AND HEALTH; HOPELESSNESS AND HEALTH;  
OPTIMISM, PESSIMISM, AND HEALTH

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## PAIN: PSYCHOSOCIAL ASPECTS

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Pain is a ubiquitous experience. Everyone experiences some kind of pain at some point in his or her life. Most common pain we experience is acute and transient in nature. It can be quite unpleasant, yet it does not cause any significant tissue damage or have long-term effects on our health. Such pain generally goes away on its own or with over-the-counter medical aids.

However, pain can also represent serious illnesses, or become disabling on its own as with a clinical pain disorder. Pain is one of the most common reasons for seeking medical care, accounting for more than 70 million office visits to physicians each year. Chronic and recurrent episodic pain are among the most common physical problems in the United States, with an estimated 90 million suffering from one or more pain syndromes.

Pain is a complex perceptual phenomenon. The International Association for the Study of Pain's (IASP) definition of pain reflects the complexity of pain as a phenomenological experience unique to each person. According to the IASP (1986) definition, pain is "an unpleasant sensory and emotional experience normally associated with tissue damage or described in terms of such damage." An important first step to understand pain is to clarify its difference from *nociception*. Nociception is a sensory process involving receptor activation (transduction), relay of information from the periphery to the central nervous system (transmission), and neural activity leading to control of the pain transmission pathway (modulation). Pain,

on the other hand, is an integrated perceptual process. Nociception may lead to pain perception, but it is not sufficient to account for pain as a clinical presentation. Thus, nociception is not synonymous with pain. The former is a physiological phenomenon, whereas the latter is a perceptual one, involving higher central nervous system mechanisms.

### CONCEPTUALIZATIONS OF PAIN

In general, pain is considered as a warning sign implicating a disease or injury, and thus, many people consider it a "physical phenomenon." Scholars and clinicians have conventionally accepted this assumption for centuries. On the other hand, when pain could not be accounted for by physical findings only, as in many cases of clinical pain syndromes, pain was considered as "mental." Cartesian mind-body dualism dominated for centuries as a way of understanding pain, in which pain was somatic if there is an organic cause accounting for the experience or pain is "psychological" otherwise. It is only in the past quarter century that there has been a significant paradigm shift in thinking about pain as an integrated perceptual experience.

### Sensory Model

Traditionally, there has been an implicit assumption that an isomorphic relationship exists between pain and nociception; pain was viewed as a sensory experience that should directly and linearly correspond to the degrees of noxious sensory stimuli impinging on the individual. Based on this model, the

extent of organic pathology must account for the presence and extent of pain.

However, recent advancement in neural imaging helps us understand that the linear relationship between pathology and pain rarely exists. There are a large number of patients with severe pain syndrome whose exact pathology cannot be objectively identified, despite undergoing thorough diagnostic testing. It is also common to see patients who undergo an identical operation vary widely not only in their reports of postoperative pain severity but also in their responses to treatment. Conversely, imaging studies using computed tomography (CT) scans and magnetic resonance imaging (MRI) often reveal the presence of significant pathology in about a third of asymptomatic individuals.

### Psychogenic Perspectives

When the presence of pain cannot be explained by physical pathology, conventional medical thinking was to consider those symptoms as psychological in origin. Similarly, if the pain is disproportionate to objectively determined physical pathology or if a patient does not respond to medical treatment targeted to modify nociceptive input, then pain is assumed to be also psychological. Psychological distress or specific ("pain prone") personality is believed to manifest itself as "physical" pain. The psychogenic model exists as an alternative model to the sensory model; thus pain is either somatic or psychological. If the report of pain occurs in the absence of or is "disproportionate" to objective physical pathology, *ipso facto*, the pain must be "all in their head." However, the model has not produced any empirical support, and the assumptions and logic of the model have been repeatedly questioned.

### Toward an Integrated Model: Gate Control Model

Melzack and Wall (1965) were the first to integrate physical and psychological factors in pain perception with three dimensions incorporated: sensory-discriminative, motivational-affective, and cognitive-evaluative. This model, widely known as gate control theory, proposes that a mechanism in the dorsal horn of the spinal cord acts as a gate keeper that controls neural transmission of nociceptive events. The gating mechanisms are considered to be supported by the inhibitory activity in A-beta (large-diameter) and the

facilitatory activity in the c (small-diameter) fiber in the dorsal horn. In addition, the model postulates that the cortical variables, such as anxiety, memory, and attention, interact with the spinal gating system to determine the final product: pain perception. The validity of the model has been challenged over the years; however, the model stimulated the development of comprehensive models that may explain how psychological factors modulate human pain experience.

### BIOPSYCHOSOCIAL MODEL OF CHRONIC PAIN

The biopsychosocial view provides an integrated model for pain that incorporates purely mechanical and physiological processes as well as psychological and social contextual variables that may cause and perpetuate chronic pain. In contrast to the biomedical model's emphasis on the disease process, the biopsychosocial model views illness as a dynamic and reciprocal interaction between biological, psychological, and sociocultural variables that shape the person's response to pain.

The biopsychosocial model presumes at its core physical changes in the muscles, joints, or nerves that generate nociceptive input to the brain. At the periphery nociceptive fibers transmit sensations that may or may not be interpreted as pain. Such sensation is not yet considered pain until subjected to higher-order psychological and mental processing that involves perception, appraisal, and behavior. Perception involves the interpretation of nociceptive input and identifies the type of pain (i.e., sharp, burning, punishing, cruel). Appraisal involves the meaning that is attributed to the pain and influences subsequent behaviors. The individual may choose to ignore the pain and continue working, walking, socializing, and engaging in previous levels of activity or may choose to leave work, refrain from all activity, and assume the sick role. In turn, this interpersonal role is shaped by responses from significant others that may promote the healthy and active response or the sick role. The biopsychosocial model has been instrumental in the development of cognitive-behavioral treatment approaches for various clinical pain disorders.

### PSYCHOLOGICAL CONTRIBUTORS TO PAIN

This section reviews specific psychological factors that have been shown to influence pain experience, based on the biopsychosocial model.



## Learning Factors

Pain is an unavoidable part of human lives. No learning is required to activate nociceptive receptors. Pain is inherently aversive, prompting us to escape from it, and subsequently avoid, modify, or cope with pain or cues associated with potentially painful experience.

At the acute stage of pain, healing of tissue damage causing pain is essential. However, at some point, we all need to resume our normal life activities. Unfortunately, some people develop a conditioned fear to physical activities, because such activities may temporarily aggravate pain. Avoidance of pain is a powerful rationale for reduction of activity. Many pain patients express fear of aggravating their pain, and muscle soreness associated with exercise functions as a justification for further avoidance. Although it may be useful to reduce movement in the acute stage, limitation of activities can be chronically maintained not only by pain but also by anticipatory fear well after the healing period is over. Over time, fear of pain and avoidance of activities may become generalized to a wide range of life functioning including work, leisure, and sexual activities.

From the operant learning paradigm, overt behaviors indicative of pain can be reinforced and thus maintained via environmental contingency. When a person experiences pain, the immediate behavior is to escape from it. Or a person may limp or brace the affected area in order to protect the area. Such behaviors are adaptive and appropriate. However, these behaviors can be maladaptively maintained via reinforcement. For example, suppose that limping and groaning are always followed by sympathetic attention and solicitous help from a significant other; the positive consequence of the pain behavior reinforces the behavior and thus, the likelihood of the same behavior recurring increases. Although such behavior is likely appropriate and adaptive during the active healing of the tissue damage, once the learned behavioral pattern is established, the behavior may be governed under the control of external contingencies of reinforcement, not by the initial purpose of protecting the injured area. In a case of chronic pain, therefore, pain behavior may indicate the learned pattern of responding to the environment, rather than the adaptive pattern of protecting the body from injury.

It should be noted that the pain sufferer does not consciously emit pain behaviors to obtain reinforcers.

It is more likely to be the result of a gradual process of shaping the behaviors. Thus, a person's response to life stressors as well as how others respond to the pain sufferer can influence the experience of pain in many ways, but are not the cause of the pain condition. In this regard, it is also important not to make the mistake of viewing pain behaviors as *malingering*. Malingering involves the patient *consciously and purposely* falsifying a symptom (e.g., pain) for specific secondary gain. In the case of pain behaviors, there is no suggestion of conscious deception but rather the unintended performance of pain behaviors resulting from environmental reinforcement contingencies. The person is typically not aware that these behaviors are being displayed, nor does he or she consciously intend to obtain a positive reinforcement by exhibiting the behaviors.

Social learning has received some attention in acute pain and in the development and maintenance of chronic pain states. From this perspective, the acquisition of pain behaviors may occur by means of "observational" learning and "modeling" processes. That is, people can acquire responses that were not previously in their behavioral repertoire by observing others exhibit behaviors. Children acquire attitudes about health and styles of symptom perception from their parents and others close to them. The culturally acquired perception and interpretation of symptoms determine how people deal with illness. The observation of others in pain is an event that captivates attention. This attention may have survival value, may help to avoid experiencing more pain, and may help to learn what to do about acute pain.

## Cognitive Factors

Various cognitive factors influence the perception of pain as well as adaptation to pain. *Attentional* factors are important in pain experience since pain is a conscious experience. Such stories as an athlete continuing to play despite serious injury and starting to feel significant pain only after the game or an injured soldier's pain becoming unbearable only after retreating to a safe place have been told repeatedly among us. Our attentional resource is limited, and our sensory experience depends on the allocation of such resource. When the greater degree of attention is allocated toward bodily sensations, greater pain perception can be expected. Such process can be seen at the neural level; for example, distraction attenuates neural activities

in the brain regions to which pain experience generally corresponds.

In addition, *beliefs* about pain interact with attention to and appraisal of sensory events. Thus, individuals expecting noxious experience may allocate greater attention and interpret sensory experience as more aversive than those who do not. Furthermore, if a person evaluates the sensory event to be pathological, the pain experience is likely to be potentiated. For example, consider a man waking up on Monday with chest pain. If he starts thinking of his friend who had a heart attack a few months ago and believes that chest pain signifies pathology in his cardiovascular system, his pain experience is likely to be substantially greater and aversive than if he considers his tendency to overdo extraneous activities over the weekend ("I must have strained my chest muscle"). Such experience is consistent with how the brain functions in terms of expectation about pain that likely contributes to the modulation of pain. Anticipation of pain alone (without actual pain experience) is known to evoke activities in the primary somatosensory cortex.

Plenty of experimental evidence exists on the effects of pain-specific thoughts on physiological reactions. Cues such as pain-related words may trigger physiological response in pain patients. Chronic regional pain patients tend to react strongly to pain-related stressors in a symptom-specific manner. For example, if a patient has back pain, she is likely to increase muscle tension in the paraspinal region in response to pain-related stressors but not in the other regions. Another patient with neck pain is likely to increase tension in the cervical area. Clearly, pain-related thought process, even in the absence of actual pain experience, can trigger the physiological responses that may contribute to an overall pain experience.

Maladaptive cognition, *cognitive error*, is known to significantly contribute to distress and disability associated with pain. Particularly, the extreme type of cognitive error, *catastrophizing*, is associated with greater pain experience as well as severe disability and poor outcome of pain treatment. Catastrophizing is an extremely negative style of thinking about one's plight no matter how unlikely such negative outcomes may be. Catastrophizing appears to be a particularly potent way of thinking that greatly influences pain and disability.

Moreover, if individuals believe that their pain is *uncontrollable*, pessimism and depreciation of their

coping skills persist. On the other hand, if individuals believe that they are able to use coping skills effectively (*self-efficacy beliefs*), their tolerance to aversive situations increases. These cognitions seem to reciprocally influence physiological and behavioral aspects of pain. The positive effect of self-efficacy belief on pain experience seems to be mediated physiologically via the endogenous opioid system.

Successful self-regulation of pain depends on each person's specific ways of dealing with pain, adjusting to pain, and reducing or minimizing pain and distress caused by pain-coping strategies. Coping is a spontaneously employed action that has specific purpose and intention, and it can be assessed in terms of overt and covert behaviors. Overt, behavioral coping strategies include rest, medication, and relaxation. Covert coping strategies include various means of distracting oneself from pain, reassuring oneself that the pain will diminish, seeking information, and problem solving. Coping strategies are thought to alter both the perceived pain intensity and one's ability to manage or tolerate pain and to continue everyday activities.

The term coping may imply that it should always yield positive consequences; however, coping actually can be beneficial or detrimental in management of pain. Studies have found active coping strategies (e.g., efforts to function in spite of pain or to distract oneself from pain such as activity, ignoring pain) to be associated with adaptive functioning. Passive coping strategies (e.g., depending on others for help in pain control and restricted activities) were related to greater pain and depression. In a number of studies it has been demonstrated that if instructed in the use of adaptive coping strategies, the pain intensity decreases and tolerance of pain increases.

### Affective Factors

As the IASP (1986) defines it, "Pain is unquestionably a sensation in a part or parts of the body but it is also always unpleasant and therefore also an emotional experience." The affective factors associated with pain include many different emotions, but they are primarily negative in quality.

The most studied negative affect in pain is depression. Depression as a clinical syndrome as well as depressed mood is quite prevalent in people suffering from pain. Approximately 50% of people who have chronic pain are depressed. Conversely, people with major depressive disorder exhibit diminished pain

threshold and tolerance. The causal relationship between depression and pain has been debated for years. However, it is not likely to be a direct one but mediated by perceived functional interference and control over pain. Furthermore, the negative cognitions that are generally associated with depression no doubt contribute to the aversive nature of overall pain experience, as reviewed in the earlier section.

Fear and anxiety are a natural consequence of pain experience. How conditioned fear and anxiety may contribute to the maladaptation of people suffering from pain was reviewed in the earlier section. In addition, anxiety is known to potentiate pain severity during medical/dental procedures as well as postsurgically. Given these, it is not surprising that psychological treatment for pain patients generally includes the cognitive-behavioral strategies to better manage patients' anxiety and stress levels.

Another affective component particularly pertinent to chronic pain is anger. Anger has been widely observed in individuals with chronic pain. It is not just the experience of anger but how people manage their anger (i.e., expression of anger) that may influence the pain perception via the endogenous opioid system. Internalization of angry feelings is also strongly related to measures of pain intensity, depression, perceived interference, and reported frequency of pain behaviors.

Frustrations related to persistence of symptoms, limited information on etiology, and repeated treatment failures along with anger toward employers, the insurance and health care systems, family members, and themselves all contribute to the general dysphoric mood of these patients. The impact of anger and frustration on exacerbation of pain and treatment acceptance has not received adequate attention. It would be reasonable to expect that the presence of anger may serve as an aggravating factor, associated with increasing autonomic arousal and blocking motivation and acceptance of treatments oriented toward rehabilitation and disability management rather than cure, which are often the only treatments available for chronic pain.

## CONCLUDING COMMENTS

Pain is a complex subjective phenomenon composed of not only a neural activity but also a range of psychosocial factors. The psychosocial factors clearly contribute to the interpretation of nociception as pain as well as the determination of how pain affects the person.

The assessment of pain is complicated by the fact that pain is a subjective experience. There is no "pain thermometer" that can accurately determine the amount of pain an individual feels. Then how do we know if and how much a person is hurting? We can only infer it from indications such as the severity of tissue damage, verbal pain complaints, or nonverbal pain behaviors. Even with tissue damage, it is impossible to specify how much pain *should* be experienced. For example, should a cut that is 1/2" long and 1/4" deep hurt twice as much as a cut that is 1/4" long and 1/8" deep? Nociception is a sensory process and pain is a perceptual process that requires attention and interpretation of the nociceptive input. Thus, nociception and pain are not synonymous.

The review of how the psychological factors are implicated as an integrated pain experience should clarify why the unidimensional sensory and psychogenic models are not adequate in understanding human pain experience.

Several multidimensional models have been developed with the two most widely discussed: the gate control theory and the biopsychosocial model. These are not competing models; indeed, they are actually complementary to one another.

As pain becomes chronic, the weight of psychological factors becomes greater, due to the increased complexity of the interaction among cognitive, behavioral, affective, and physiological aspects of pain. Various behavioral and cognitive techniques can be incorporated in the treatment of chronic pain, with the purposes of modifying maladaptive thinking, increasing self-efficacy, and acquiring skills to manage pain and stress. The comprehensive conceptualization of pain as the biopsychosocial phenomenon helps develop cost-effective treatment programs.

—Akiko Okifuji

See also CHRONIC PAIN MANAGEMENT; HEADACHES: PSYCHOLOGICAL MANAGEMENT

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## PARTICIPATORY RESEARCH

A great deal of concern has been raised in recent years about the fact that many research results receive only limited use in actual practice. Part of the reason for the chasm between research and practice is that those who are to be the beneficiaries and users of research often wonder whether research done under highly controlled conditions, in far away communities, and with populations different from their own is applicable to their particular needs and constraints. Most efforts to improve the research-to-practice problem are "downstream" in the research process, in that they attempt to secure interest and adoption among potential users after the research is done. In contrast, participatory research represents an "upstream" approach that involves actively engaging practitioners, policymakers, and others in the research process itself—so they can help ensure that the research will be relevant to their needs and can assist in interpreting and applying the results in their community. Participatory research can therefore be defined according to a core set of three components: (1) systematic investigation (2) involving the intended beneficiaries and users of the research (3) for the purposes of education and taking action or effecting social change.

### ORIGINS AND DEVELOPMENT OF PARTICIPATORY RESEARCH APPROACHES

Participatory research has had a rich and honored tradition in health and community development. It was widely applied and honed in various forms with varied names in developing countries, where it had a

decidedly practical orientation aimed at enabling social change and community development projects to be conducted among populations suspicious of the motives of Western researchers. Among the variations of names for participatory research in health were the following:

- Participatory action research
- Participative research
- Conscientizing research
- Policy-oriented action research
- Empowerment evaluation
- Collaborative inquiry
- Dialectical research
- Emancipatory research
- Social reconnaissance
- Participatory learning research
- Participatory rural appraisal

While most investigators and participants paid at least some attention to all three of the components laid out in the definition of participatory research provided above, some laid greater emphasis on one component than the others. Those who emphasized the systematic investigation part tended to gravitate to models that put less importance on the product than on the research methodologies. Those who were concerned primarily with capacity building in the community emphasized the learning process at the possible expense of the research or the social change. Those for whom the primary concern was with social action might have sought it with some sacrifice or compromise of the scientific or the educational components.

The North American renaissance of participatory research has taken place in social, educational, and health services development and delivery, and more in urban settings, in contrast to the rural settings and agricultural focus of participatory research in developing countries. In health services, nursing has led the way with collaborative studies between academic nurses and hospital nursing administrators and staff. In this context, participatory research has been aimed at improving nursing roles and difficult working conditions that have resulted from changes in health care systems. In public health, the revival of participatory research has been most notable in minority health as a way of overcoming certain disparities in health.

As with the impetus in developing countries, the distrust of researchers has played an important part in

this demand for greater participation. Native communities, for example, after decades of serving as subjects for behavioral surveys, health education program evaluations, and epidemiological and anthropological studies, have put the brakes on external researchers exploiting their circumstances with very little gain to themselves. Similarly, African Americans living in inner-city ghettos noticed that their lives have been described in research reports in unflattering, if sympathetic, ways, but they have seen little come of it besides embarrassment and shame cast on their communities.

These and other communities recognized that they still needed information about their circumstances that only original research could provide. Meanwhile, academic and public health researchers recognized that the data they needed could not be had without more active cooperation of communities. This convergence of needs led to a reworking of the power balance between researchers and the researched. Instead of being viewed simply as research objects and giving informed consent, those who were to be researched gave their knowledge and experience to help develop the research questions to be asked and the methods to be applied in their communities. Rather than being relegated to the role of victim, as described in studies of their health problems and conditions of living, they became active partners in identifying the key problems to be addressed and then in interpreting and using the research findings in program development, monitoring, and evaluation and in advocating for policy and program changes.

#### PARTICIPATORY RESEARCH IS AN APPROACH TO RESEARCH, NOT A METHOD

This description of the origins and development of participatory research might give the impression that it is a research method designed primarily for researcher-public interaction. Yet it is neither a research method nor is it limited to circumscribing the relationship between academic researchers and the public. Instead, participatory research is an approach that entails involving any and all potential users of the research as well as other stakeholders in formulating as well as applying the research. A broad and diverse range of research methods can be applied in the service of participatory research—epidemiological, experimental, survey, focus groups, qualitative

interviews, and observation. Which methods to apply within a participatory research approach depends on a determination of which methods will best address the research questions and which are feasible in the particular setting.

#### WHO SHOULD PARTICIPATE?

Whose participation needs to be solicited and engaged in participatory research depends on who would be affected most directly by the research results. Much of the discussion in participatory research has taken place within the context of community development and community programs, and therefore assumes that participatory research must of necessity engage the lay community. Community, in this context, is usually understood to be a local geopolitical entity, as in the term community-based participatory research. Both the need and opportunity for undertaking participatory research with groups other than community residents arise, however, if other groupings of people sharing common characteristics or interests or causes are considered, or if research is to be undertaken for other purposes besides community development. Participants can therefore also consist of those sharing a particular race, ethnicity, gender, sexual orientation, or health condition, as well as health and service agencies and organizations, practitioners, managers, policymakers, and legislators.

#### HOW MUCH PARTICIPATION IS NECESSARY?

What should be considered as the minimum and maximum degree of participation in order to label research as participatory? Maximum participation occurs when those whose participation is sought remain active partners throughout the study: from formulating the research questions, to selecting the methods, to collecting the data, to analyzing the data, to interpreting and applying the findings. At the other end of the spectrum, the minimal amount of participation that can still be considered as useful consists of involving stakeholders at least in the beginning of the study in identifying the research questions and in the concluding stages of interpreting and applying the findings. This demarcation of the range of participatory research clarifies its distinction from basic and applied research that typically involves only traditionally defined researchers in the research process while viewing all others as subjects of the research, and its

distinction from action research where there is a commitment to action and analysis and where the research involves community development approaches but where those involved in the action situation (often practitioners in the practice setting) are still considered as subjects of the research.

How is it possible to determine the extent to which participation of nonresearchers should be incorporated into a given research project or a given phase of a research project? This depends in part on their wishes, in part on the participants' trust of the researchers, and in part on the complexity of the research methods and analysis. In general, there is little need (nor is there much justification) to drag volunteer participants through a labor-intensive and highly technical research process, so long as they have the opportunity to shape the research questions and to interpret and apply the findings.

#### USES OF PARTICIPATORY RESEARCH AND DEMANDS FOR ITS EXPANSION

At the same time as practitioners and communities are demanding to have a say in the research conducted in their patients or populations, legislators are calling for greater accountability of researchers to ensure that their research influences actual practice. There has also been a growing demand among funding agencies for participatory research, given its potential for education, action, and social change. The U.S. National Institute of Environmental Health Sciences (NIEHS), for example, sees participatory research as an opportunity to advance environmental science while addressing the environmental health concerns of community residents. The NIEHS and the Centers for Disease Control and Prevention (CDC) have announced research funding competitions that require all research projects to use participatory research approaches, while other federal and nonfederal agencies have also shown a growing tendency to support the use participatory research approaches in many of their grant programs.

The vast majority of research conducted today does not incorporate participatory research approaches. Should all research be participatory? A rule of thumb as to what research might benefit from participatory research approaches is that if the research findings are intended to be used by one or more particular groups, then the findings might be more likely to be used if

members of that group have been involved in the research—so that the research is conceptualized, constructed, interpreted, and applied to meet their needs as they perceive them, rather than only addressing what others perceive to be their needs.

Participatory research seeks to contribute to better use of science, better application of research results, and better dissemination of research findings. To ensure better use and application of research, it must be seen as relevant to the local and immediate circumstances of those who would use it. The research that is synthesized into “best practices” comes from carefully controlled trials in distant places under the direction and resources of equally foreign scientific groups. Local practitioners and policymakers have good reason to suspect that their circumstances are different from those represented in the studies that underpin the best practices. Participatory research offers them an opportunity to examine their own circumstances, to pilot test the best practices within their own context, and to adapt them to their own needs. This, in turn, provides valuable data to the research community as it seeks to extend the relevance of evidence-based guidelines and best practices into other areas of health and other populations. Health agencies can provide the bridge between university-based researchers and patient self-help groups and community-based projects, using participatory research at the clinical or agency level to adapt best practices, and at the community level to ensure relevance of the research to the community's needs and actions.

—Lawrence W. Green and  
Shawna L. Mercer

See also CHURCH-BASED INTERVENTIONS; COMMUNITY-BASED PARTICIPATORY RESEARCH; COMMUNITY COALITIONS; CULTURAL FACTORS AND HEALTH; HEALTH DISPARITIES; IMMIGRANT POPULATIONS AND HEALTH; KEY INFORMANTS; SELF-EFFICACY; SOCIAL CAPITAL AND HEALTH

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## PEPTIC ULCERS AND STRESS

### EVIDENCE AND CONTROVERSY

- At 5:46 a.m. on January 17, 1995, a major earthquake devastated the Hanshin-Awaji area of Japan. More than 6,000 people were killed, and 300,000 had to be evacuated from their homes. During the next 2 months, there were 3 times as many bleeding ulcers detected at local hospitals as in the same period of the previous year.
- During 1971-1975, the National Health and Nutrition Examination Survey asked 2,511 Americans how much "strain, stress, or pressure" they were under. Ten years later, those who had felt under a great deal of stress were 3 times as likely to have an ulcer than those who felt no stress at all.
- Researchers found that 44% of English patients with new ulcers had been having serious, objective life difficulties during the past 6 months, as compared with only 9% of healthy people of similar age and background.
- Among Italian patients who had recently developed ulcers, those who scored in the highest third on an anxiety questionnaire were 4 times as likely to remain unhealed after a standard course of treatment.
- In a study of 2,109 Swiss ulcer patients, those classified by their physicians as under stress were twice as likely to relapse during the first year after cure.

There is a wealth of research demonstrating that people who are experiencing life stress are more likely to develop an ulcer of the stomach or the duodenum and that their ulcers are harder to cure. The stereotype of the frazzled executive reaching for his bottle of Maalox every time he slams down his telephone is misleading only in its suggestion that ulcers are more common in the rich than in the poor (in fact it is the other way around).

On the other hand, in recent years it has been widely stated that ulcers are caused not by stress but

by an "ulcer germ," *Helicobacter pylori*. Since the early 1990s, the discrepancy between these two rival explanations has been confusing physicians as well as the lay public about the role of psychological factors in ulcer disease.

The hunch of an Australian scientist, Barry Marshall, who believed that bacteria might be involved in ulcers, was so revolutionary that it took 15 years to convince the medical community. We now know he was right: *Helicobacter pylori* lives in the stomach of most ulcer patients, and many people who suffered from ulcer pain for decades have been given permanent relief by a single brief course of antibiotics. The *Helicobacter* story has not only clarified the origins of one specific disease and improved the lives of many patients but has opened the door to a paradigm shift in medical science by suggesting that infectious agents may play a role in many chronic diseases, including heart attacks and cancer.

The relation between *Helicobacter* and ulcer is not so simple, however. It is true that most people with ulcers are infected, but so are a large percentage of healthy adults: Half of Americans over age 60, and 90% of all African adults, have *Helicobacter pylori* in their bodies, many of them without a twinge of indigestion. And, contrariwise, as many as one ulcer in four develop in people who have never had a *Helicobacter* infection, confirming that the ulcer story is larger than just *Helicobacter pylori*.

*Helicobacter pylori* usually settles into the body during childhood, but ulcers rarely develop before the age of 30, and only one in five people with *Helicobacter pylori* infections ever develops an ulcer. Clearly, additional factors, psychological or nonpsychological, must be involved if a person's relationship with his or her resident *Helicobacter* makes the leap from peaceful coexistence to ulcer. Similarly, only a small proportion of people who are coughed on by somebody with tuberculosis, or who have strep in their throats, become ill.

Barry Marshall himself has warned against overstating the implications of his discovery. To determine the toxic effects of *Helicobacter pylori*, Marshall once bravely downed a concoction of live bacteria. When he then looked inside his own stomach, he saw that the bacteria had caused inflammation—but not an actual ulcer. Based on this and other evidence, Marshall wrote that according to Koch's criteria, the standard method for proving that a given infectious agent causes a given disease, his germ had not been demonstrated to cause ulcer.

Important as it is to avoid overestimating the role of *Helicobacter pylori* in ulcer disease, it is equally vital to recognize a series of pitfalls that can lead to overestimating the role of stress.

For one thing, sick people like having explanations for their sickness, and stress is a popular one, especially when the disease is as notoriously “psychosomatic” as ulcer. Furthermore, being sick is in itself stressful. Ulcer patients have been consistently found to be more anxious, depressed, and hostile than control groups. But having constant stomach pain could itself lead to anxiety, depression, and irritability, so the psychological characteristics could result from the disease instead of the other way around.

Socioeconomic status constitutes a special pitfall in ulcer research. The poor are particularly likely to have ulcers, both because *Helicobacter pylori* infection is rampant in conditions of crowding and inferior hygiene and because heavy physical labor increases ulcer risk. Since the poor are also particularly likely to have stressful lives, a study that looks at the general population is likely to show an artifactually strong association between stress and ulcer.

## HOW ULCERS DEVELOP

To understand the role of psychological factors, it is useful to review a few medical facts. An ulcer (sometimes called “peptic” after pepsin, an enzyme found in gastric juices) is an open sore where stomach acid has eaten its way into the lining of either the stomach itself or the duodenal bulb, located where the stomach ends and the intestine begins. Ulcers do not ordinarily occur lower down in the intestine, because bicarbonate pours into the mix just inches past the bulb and neutralizes the stomach acid.

In a way, it’s a miracle we don’t all have ulcers. Glands inside the stomach are constantly churning out hydrochloric acid, which gets the process of digestion going by reducing the food we have eaten to pulp. When a hungry person smells a juicy steak, the acidity of the stomach contents can be 10 times stronger than vinegar.

So why doesn’t that same acid reduce the stomach itself to pulp?

One answer is that the entire gastrointestinal tube is coated with a thin layer of protective mucus. A second answer is buffering of acid by food: Stomach acidity hits its peak as we start eating, but the acid starts to be neutralized by the first chewed-up bite as soon as it emerges from the far end of the esophagus.

Under ordinary circumstances, there is a nice balance between acid production on the one side and protective forces like mucus and food on the other, so the lining of the stomach and the duodenum remains intact. Ulcer-promoting factors throw off that balance either by increasing gastric acid or by decreasing the protective forces.

*Helicobacter pylori* disturbs the balance chiefly by degrading the quality of the protective mucus. Cigarette smoking and having Type O blood help *Helicobacter pylori* to do its damage; they do not seem to cause ulcers in people who are not infected. Nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin or ibuprofen, the chief causes of non-*Helicobacter* ulcers, also degrade the mucus defenses.

Other risk factors act by increasing the quantity of acid that ulcer-susceptible tissues are exposed to. A high level of pepsinogen in the blood, which runs in families, is associated with high rates of acid secretion, as is heavy physical labor. Abnormal gastric contractions can cause acid to stagnate at length in the stomach or to be dumped copiously into the duodenum. And skipping breakfast increases the contact between acid and the stomach and duodenal lining by prolonging the nighttime period when there is no buffering by food.

## MECHANISMS OF STRESS

So how do psychological factors promote ulcers? The classic explanation is that stress puts the lining of the upper gastrointestinal tract at risk by stimulating the stomach to secrete high levels of acid. This is correct as far as it goes, since acid production is in fact stimulated by stress in human beings (though, curiously, not in monkeys, our close animal relatives).

But other physiological mechanisms seem at least as important in the pathway between stress and ulcer formation. Stress decreases blood circulation in the gastrointestinal tract, rendering it more susceptible to damage, and it can also affect gastrointestinal contractions. Life stress is known to interfere with the process of wound healing, which may contribute to the poor prognosis of ulcers in patients who are chronically anxious or experiencing a particularly difficult period. Psychological factors may directly disrupt a long-standing equilibrium between *Helicobacter* and its host, both because *Helicobacter pylori* flourishes in the presence of high acid levels and, conceivably, by affecting immune defenses against *Helicobacter*.



Stress can also promote ulcer formation indirectly, by influencing behavior. Many behavioral patterns associated with life stress and psychological distress—heavy alcohol consumption, cigarette smoking, irregular eating habits, sleeplessness—are also risk factors for ulcer. People also take more NSAIDs when they are under stress, whether because they are getting more headaches or in the hope an aspirin will calm them down or help them sleep. These behavioral concomitants of stress are extremely important, explaining about half of the causative effect of stress on ulcers. It is therefore vital for health care workers to discuss food and sleep rhythms and substance use with ulcer patients, emphasizing the chain of causality from stress to unhealthy behavior patterns to disease.

Beyond such counseling around health risk behaviors, there does not seem to be a major place for psychologically oriented interventions in the average patient with an ulcer. Modern medical therapy heals nearly all ulcers rapidly and easily, while chronic disease can almost always be avoided using *Helicobacter pylori* eradication therapy, early treatment of symptom recurrences, or in the worst case nontoxic maintenance regimens. The modest effect on ulcer symptoms from dynamically oriented individual psychotherapy or cognitive interventions hinted at in two clinical trials is dwarfed by the efficacy of modern medical therapy. In the one published head-to-head trial, a psychologically oriented intervention (group counseling) was significantly inferior to maintenance therapy with H<sub>2</sub>-receptor blockers, and was in fact indistinguishable from placebo. In yet another trial, cognitive intervention was associated, disconcertingly, with significantly *increased* ulcer recurrence rates.

Midcentury medical lore held that hospitalization, by removing the ulcer patient from a stressful life situation, was in itself therapeutic. Recent confirmation that anxiety impedes ulcer healing lends credence to these older concepts, the weak results of published trials being due in large part to their enrolling unselected ulcer patients. Psychotherapy or cognitive-behavioral therapy may indeed have something to offer in the treatment of peptic ulcer, but only in a few highly motivated patients with high perceived stress levels and resistant disease.

## PAST AND FUTURE

Ulcers were uncommon in 19th-century Europe and America but burgeoned after 1900, to the point

that one out of eight people born around 1910 was destined for an ulcer. The ulcer epidemic happened to correspond with the rise of psychoanalysis and of psychosomatic medicine, whose proponents spotlighted the apparently overwhelming association of peptic ulcer with stress and the success of rest and relaxation in healing it. What was known at the time of ulcer physiology, which focused chiefly on excess secretion of gastric acid, jibed perfectly with a psychosomatic cause.

Ironically, as the origins of peptic ulcer were becoming clear in the 1980s, the epidemic was already receding—probably because hygienic improvements were preventing children from acquiring *Helicobacter pylori* from older friends and family members. So concepts of peptic ulcer have changed radically: In the middle of the 20th century it was a common and disabling disease, often required surgery, and was a model for the ability of psychological distress to cause disease. Fifty years later, ulcer is relatively uncommon, can usually be eliminated with a brief course of medication, and is a model for the ability of bacteria to cause unexpected damage.

It is tempting to take sides and consider the cause of ulcers either as stress or as *Helicobacter pylori*. The truth is more complex and more interesting: There is no single culprit. Peptic ulcer results from the massed effect of various risk factors, with different combinations active in any individual patient. In the same way, coronary artery disease has long been conceptualized in terms of risk factors, which include both high cholesterol and psychological stress. It is by now well accepted that stress can influence heart attacks, angina pectoris, and sudden death, but this discovery has not prompted fruitless debates over whether psychological factors are “the cause” of heart disease. As the novelty of *Helicobacter pylori* wears off, the medical community is likely to arrive at a willingness to embrace the complexity of mind-body interactions in understanding the causation of peptic ulcer as well.

—Susan Levenstein

See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
GASTRIC ULCERS AND STRESS; STRESS: BIOLOGICAL  
ASPECTS; STRESS, APPRAISAL, AND COPING

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## PHYSICAL ACTIVITY AND HEALTH

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. Physical activity is a broad term that captures virtually every type of physically active behavior including competitive and recreational sports, active forms of transportation (e.g., cycling to work), leisure activities (e.g., hiking), occupational activities (e.g., firefighting), household chores (e.g., sweeping), and exercise. Exercise is a specific subtype of physical activity that is performed to improve health and/or physical fitness. It includes activities such as aerobic endurance training (e.g., swimming, jogging), strength training (e.g., lifting weights, doing push ups), and flexibility training (e.g., yoga, stretching).

A relationship between physical activity and health was first suggested by British researchers who found a greater incidence of heart disease among double-decker bus drivers than bus conductors (Morris, Kagan, Pattison, Gardner, & Raffle, 1966). The researchers surmised that conductors might have been less prone to heart disease than drivers because they were more physically active during their work day. The conductors climbed up and down the bus stairs all day collecting fares, while the drivers sat behind the wheel.

Since the bus driver study, considerable research has examined the association between physical activity and health. For example, a study of almost 17,000 Harvard alumni from 1962 to 1978 found that all-cause mortality (death by any cause) was 53% lower for men who participated in at least 3 hours of sports activity per week than for men who engaged in less than 1 hour of sports activity per week (Paffenbarger, Hyde, Wing, & Hsieh, 1986). These activity-related reductions in mortality are largely due to the health-promoting effects of being physically fit. Men and women who are very fit have approximately a 75% lower death rate than individuals who are very unfit. Fortunately, unfit, inactive people who start an exercise program and who become physically fit can decrease their risk of death by about 44% (Blair et al., 1995). Thus, it is never too late to start exercising—greater physical fitness is associated with lower mortality among adults of all ages.

If physically fit and active people are less likely to die, then it stands to reason that they are also less likely to get sick. Indeed, four decades' worth of

research indicate that exercise reduces the risk of developing a variety of physical and mental health problems. Exercise is also an effective therapeutic modality for people with certain physical and mental health ailments.

## EXERCISE AND PHYSICAL HEALTH

Most health researchers have focused on the relationship between physical health and *exercise* rather than on the relationship between health and other types of physical activity. Based on this research, it is now well established that a regular program of exercise reduces the risk or delays the onset of coronary heart disease, hypertension, colon cancer, and diabetes mellitus. The association between exercise and other diseases and disabling conditions such as stroke, arthritis, osteoporosis, and certain cancers (e.g., endometrial, breast, and prostate) is still under investigation, but it is believed that exercise may prevent or delay the progression of these conditions.

### How Are Physical Health Benefits Achieved Through Exercise?

Long-term physiological adaptations underlie the health benefits associated with regular exercise. Regular endurance training leads to adaptations primarily in the cardiorespiratory system whereas strength training elicits adaptations primarily in the musculoskeletal system. Other types of exercise including flexibility, speed, and agility training also bring along positive physiological changes but are outside the scope of this summary.

*Endurance exercise* (aerobic exercise) is continuous activity that produces a short-term elevation in heart rate and breathing rate. It results in a slight increase in the cross-sectional area of trained muscle fibers, as well as improved fat-burning capacity and significant increases in the ability of muscle cells to deliver, uptake, and utilize oxygen (i.e., increased oxygen uptake or  $VO_{2max}$ ). Regular participation in endurance exercise also results in a lower heart rate (number of beats per minute) at rest and during activity, and, just like any other muscle, the heart is strengthened as a result of exercise training. Consequently, each heart contraction becomes more forceful. This helps the heart to empty itself of blood more fully with each beat and results in an increased stroke volume (the volume of blood pumped per beat).

In people with hypertension (high blood pressure), exercise training can decrease resting blood pressure. Taken together, these exercise-related adaptations increase the efficiency of the heart and subsequently lead to improvements in cardiorespiratory fitness. Such improvements are equally achievable by both men and women regardless of their age and are associated with a dramatic reduction in morbidity and mortality from coronary artery disease, diabetes mellitus, colon cancer, and possibly stroke and other forms of cancer.

*Strength training* (resistance training/exercise) includes activities that challenge muscles by providing them with more than normal resistance to movement. Repeated bouts of exercise that involve lifting a moderate- to heavy-weight load with a smaller number of repetitions (6-8) will increase muscular strength. Increased strength is associated with increased muscle size (hypertrophy) and increased efficiency of communication between the nervous system (i.e., the brain) and the muscle. Repeated bouts of exercise that involve lifting a light- to moderate-weight load with a greater number of repetitions (10-12) will result in greater muscle endurance due to improved oxygen delivery and uptake in the trained muscle. There will also be some increase in strength due to an increase in muscle size. The *relative* amount of this increase is similar for men and women and remains fairly constant across the life span.

With increased strength, individuals are able to lift heavier loads, and with increased endurance, muscle fatigue is delayed. Resistance training can help to maintain posture and potentially delay the progression of osteoporosis (low bone density)—a common health concern for postmenopausal women. For older adults, exercise that promotes muscle strength and balance helps to prevent falls. Falls represent a major cause of morbidity and mortality among the older population.

### Exercise Prescription to Improve Physical Health

There is a dose-response relationship between exercise and physical change, which means that the greater the dose of exercise, the greater the effects. There are different guidelines for prescribing endurance exercise versus resistance exercise. These guidelines indicate the amount of exercise needed to obtain physiological and, ultimately, health benefits.

To accrue the benefits of *endurance exercise*, the dose must take into account the frequency, intensity,

and duration of the exercise regimen. The standard recommendation is that on most days of the week, individuals participate in 30 minutes of moderate-intensity exercise. Moderate-intensity exercise is activity that requires approximately 3 to 6 times as much energy as one expends while at rest. For most people, this is equivalent to brisk walking.

It is important to note that as long as these frequency, intensity, and duration aspects of the prescription are met, the training effects are similar regardless of the *type* of endurance exercise performed (e.g., jogging, swimming, brisk walking). Moreover, there is emerging evidence that people who engage in *traditional* endurance exercise programs (e.g., aerobics classes, swimming) accrue the same physiological and health benefits as people who opt for a program of *lifestyle* physical activity. Lifestyle physical activity programs encourage the incorporation of 30 minutes' worth of several short bouts of moderate-intensity exercise into daily routines (e.g., climbing stairs, walking to work, doing yard work), rather than trying to accumulate all 30 minutes of exercise in a single bout. The promotion of lifestyle physical activity as a form of exercise is a relatively new concept. Consequently, more research is needed to gain a better understanding of the long-term benefits of lifestyle physical activity on health.

To accrue the benefits of *resistance training*, the dose must take into account repetitions (number of times each exercise is repeated), weight of the load being lifted, and sets (number of times each series of repetitions is performed). Muscular *strength* is best developed by performing one-three sets of 6-8 repetitions of a resistance exercise (e.g., lifting and lowering a dumbbell) with a heavy weight, defined as 80% of the maximum amount of weight the individual can lift and lower once. Muscular *endurance* is best developed by performing a minimum of one set of 10-12 repetitions of a resistance exercise using lighter weights, defined as 40% to 50% of the maximum amount of weight that can be lifted and lowered once. The former training regime is more suitable for serious weight lifters and the latter regime is more suitable for average healthy adults. Resistance training should be performed 2-3 days/week with a day off between workouts to allow trained muscle groups time to recover. It is important to note that the health benefits of resistance training are manifested only in the area of the body that is being trained. Thus, exercisers should ensure that they are performing exercises that work the desired muscle group.

## PHYSICAL ACTIVITY AND MENTAL HEALTH

Participation in various types of physical activity (e.g., sports, leisure, exercise) has been linked with a general sense of "feeling good." These positive, activity-induced feelings are associated with better mental health among the general population as well as individuals who are psychologically distressed.

In the general population, single, acute bouts of physical activity have proven effective for elevating mood (e.g., increasing feelings of energy and tranquility, decreasing feelings of anxiety and depression). Longer-term physical activity programs have proven effective for improving thoughts and feelings about oneself in general (i.e., self-esteem), and about specific aspects of oneself (e.g., body image, self-efficacy for performing physical tasks, perceptions of control over certain aspects of one's life). Interestingly, physical activity seems to have its greatest effects on the people who feel the worst about themselves. In other words, people in a bad mood or who have very low general and/or specific self-perceptions will show the greatest improvements along these dimensions as a result of physical activity participation. Moreover, exercise is important for preventing mental health disorders as fit individuals have a lower incidence of anxiety and depressive disorders than unfit individuals.

For individuals who are psychologically distressed, exercise may be an effective treatment strategy. Among individuals diagnosed with a mental illness such as an anxiety or depressive disorder, exercise has been found to be just as effective in reducing feelings of distress as many conventional therapies such as relaxation, occupational therapy, and drug therapy. Similarly, exercise can be an effective strategy for reducing pain and the psychological distress associated with a chronic pain condition (e.g., osteoarthritis).

### How Are Mental Health Benefits Achieved Through Physical Activity?

To accrue the mental health benefits of physical activity participation, it is not essential to improve physical fitness. This suggests that unlike the *physical* health benefits of physical activity, the *mental* health benefits are not derived solely from physiological adaptations. Currently, it is unclear exactly how physical activity leads to improved mental health, but several psychologically and physiologically based

explanations have been advanced. Psychologically based explanations include the propositions that exercise creates a sense of accomplishment, provides opportunities for social interaction, and distracts attention from daily stressors, thus contributing to improved mental health. Physiologically based explanations include the hypotheses that biochemicals that enhance feelings of well-being (e.g., endorphins, certain neurotransmitters) are released into the bloodstream as a consequence of physical activity and that activity elevates core body temperature, thus promoting decreased muscle tension and improving sleep quality. Individually, none of these explanations can fully account for the positive effects of physical activity on mental well-being. It is likely, however, that a combination of psychological and physiological mechanisms accounts for the effects.

### Physical Activity Prescription to Improve Mental Health

It is unclear exactly what dosage of activity produces the greatest mental health benefits. For instance, the frequency, intensity, and duration aspects of exercise seem to be of only modest importance in determining the extent to which exercisers experience improvements in depression and anxiety. This suggests that the exercise prescription can take many forms when the goal is to reduce depressive and anxiety symptoms. It does seem, however, that whereas most types of physical activity (e.g., exercise, sports) can enhance general and specific self-perceptions, only exercise reduces depression and anxiety. Thus, the type of physical activity may be an important consideration when prescribing exercise to improve certain aspects of mental health.

—Amy E. Latimer and  
Kathleen A. Martin

See also CANCER AND PHYSICAL ACTIVITY; CARDIAC REHABILITATION; HEART DISEASE AND PHYSICAL ACTIVITY; PHYSICAL ACTIVITY INTERVENTIONS; PHYSICAL ACTIVITY AND MOOD

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## PHYSICAL ACTIVITY INTERVENTIONS

The importance of physical activity has been well documented in the scientific literature. For example, in 1996, the Office of the Surgeon General's report stated that there is an expansive and strong body of scientific evidence that demonstrates that regular physical activity can prevent or control a number of chronic diseases and conditions, including cardiovascular disease, stroke, Type 2 diabetes, hypertension, obesity, osteoporosis, and certain types of cancer. When people engage in the recommended amount of physical activity, they can reduce their risk for many diseases and increase their overall level of health, functioning, and quality of life. Despite this knowledge, physical inactivity has been increasingly documented as a major public health issue in the United States as well as other industrialized nations. In light of the pervasiveness of physical inactivity, a growing amount of research has been aimed at developing effective interventions for promoting regular physical activity increases in a range of settings and populations.

Research on the behavioral epidemiology of physical activity has explored the prevalence of physical activity among different population segments, factors that may influence whether persons engage in physical activity or not, and what the characteristics of active versus inactive persons are. For example, in a study conducted by Caspersen and colleagues with adults in the United States, Canada, England, and Australia, it was found that, across these countries, approximately 30% of adults are sedentary. Sedentary was defined as engaging in no leisure-time physical activity. Additional research has found that there are differences in physical activity levels between different groups of people. The 1996 Office of the Surgeon General's report summarized the epidemiological findings of population-level studies of physical activity and reported that, among adults, women are less active than men, older people are less active than younger people, and that, as education and income decrease, inactivity increases. Additional research has shown that as children grow older, they become less physically active. Research with youth has also demonstrated that while boys tend to be more active than girls at most ages, by age 18, differences between boys and girls in physical activity levels are minimal.

In general, the epidemiological research demonstrates that the majority of the public needs to increase their physical activity levels to meet recommended guidelines. However, systematic attempts to promote regular physical activity participation have brought to light the many challenges of attempting to intervene on this complex health behavior. Such challenges include accurately assessing more moderate-intensity forms of physical activity, developing interventions that reach the large numbers of individuals who could benefit from physical activity increases, and identifying the most effective strategies for promoting sustained physical activity participation in the face of the many personal and environmental obstacles to being active that often occur across time.

The majority of the physical activity interventions that have been undertaken to date tend to target specific age groups, and typically have occurred at individual or interpersonal levels of impact. Therefore, this entry focuses on the current state of physical activity interventions within each age group. In addition, discussion focuses on the settings of the interventions (i.e., home, school, work, health care), and

the channels through which the interventions take place (i.e., individual, group, environmental, policy).

## PHYSICAL ACTIVITY INTERVENTIONS WITH YOUTH

Many intervention studies with youth ages 5 to 13 years (i.e., elementary and middle school-age populations) have been school based. These interventions have often focused on curriculum changes in physical education (PE) classes. One example of this is the SPARK study (Sports, Play and Active Recreation for Kids) conducted by Sallis and colleagues with 955 fourth- and fifth-grade children. The investigators compared an intervention delivered by trained classroom teachers or trained PE specialists with a control group. Students in these groups were compared on a variety of factors, including total minutes of PE per week, minutes of physical activity during PE, and use of quality teaching methods by the teachers. The researchers found that, compared to the control group, trained classroom teachers were able to almost double the number of minutes per week in physical activity during the PE classes. PE specialists were able to increase the number of minutes even more. However, Sallis and colleagues did not find that children increased their levels of physical activity outside of school, despite efforts to train the children in self-management techniques for increasing overall physical activity.

Other studies that have been conducted within school PE curricula have been successful as well. For example, the CATCH study (Child and Adolescent Trial for Cardiovascular Health), conducted by Luepker and colleagues, employed an intervention in PE classes for third- through fifth-grade students in 96 schools. Similar to the SPARK study, this intervention involved training PE specialists and PE teachers on ways to increase the time of enjoyable moderate and vigorous physical activity during PE class. Children in classes that received the CATCH intervention (vs. control classes) were able to increase their moderate and vigorous physical activity to 50% of class time, whereas controls were at 42% at the end of the 3-year study. The CATCH trial was also able to increase physical activity levels outside of school through a home/family component of the intervention.

Stone and colleagues conducted a recent review of physical activity intervention studies with youth and found that since 1980, 22 of the studies were school based and only 7 were community based. This is in

contrast to the observation that children engage in much of their physical activity outside of school. At the time of that review, little attention had been given to middle school children. Since then, there have been an increasing number of studies that have focused primarily on middle school children. One study currently being conducted by Dziewaltowski and colleagues is the Healthy Youth Places Project. This study uses a school-based intervention, but takes a more ecological approach as well. The intervention being evaluated takes into account the places where middle school children spend most of their time, including the classroom, the lunchroom, and in afterschool programs, as well as evaluating the influence adults involved in these programs (i.e., school staff with an interest in health promotion) have on the children.

A second intervention trial conducted in middle schools by Sallis and colleagues also focused more on environmental and policy factors outside of the classroom. Unlike previous studies, this study did not use classroom education. Instead, the focus of the intervention was on changing school policies and environments to allow for more opportunities to engage in physical activity at school. This approach proved to be effective. Researchers found that, after 2 years, children in the intervention schools increased their physical activity levels over that of children in control schools. Interestingly, however, this effect was found only for boys and not for girls. Such ecological approaches deserve further attention in future intervention studies. In addition, gender-specific interventions may need to be designed to allow for improvement in both boys and girls.

#### PHYSICAL ACTIVITY INTERVENTIONS WITH ADOLESCENTS AND YOUNG ADULTS

There have also been studies employing interventions targeted at adolescents (approximately high school to college age). Stone and colleagues' review of youth intervention studies identified seven intervention studies conducted with adolescents as the target population. All but one of these studies involved interventions that were conducted through schools in PE classes. One school-based study, conducted by Killen and colleagues, was the Stanford Adolescent Heart Health Program. The focus of this study was on reducing risks for cardiovascular disease; thus, the intervention contained several components of risk reduction, including increasing physical activity, decreasing smoking, and adopting a

"heart-healthy" diet. Participants in this study included 1,447 students ages 14 to 16 years in four different high schools. Two schools received the intervention and two schools served as controls.

As with the youth studies previously described, the intervention for this study was delivered within the context of students' regular PE classes. Students were exposed to 20 class sessions of intervention material in which they were given information about the topic under discussion, were taught skills to help them change negative health behaviors, and developed skills to resist outside factors that could influence whether they engaged in unhealthy behaviors. The control schools did not receive any instruction. It was found that students in the treatment schools gained more knowledge than those in the control schools. It was also found that more sedentary students in the treatment schools engaged in regular exercise at follow-up than those in the control schools.

A recent study called PACE+ (Patient-Centered Assessment and Counseling for Exercise Plus Nutrition), conducted by Patrick and colleagues, targeted adolescents in a primary care setting. This study is one of the first to employ a more ecological or community approach with adolescents, rather than using the school environment. The intervention for this study focused on increasing moderate and vigorous physical activity, as well as decreasing fat intake and increasing fruit and vegetable consumption. Participants were randomly assigned to either a mail-only, infrequent telephone and mail contact, or frequent telephone and mail contact intervention. Researchers found increases in moderate but not vigorous physical activity in all three groups across the 4-month study period.

A focus on school-based interventions can also be found in the college environment. The Project GRAD (Graduate Ready for Activity Daily) study, conducted by Calfas and colleagues, examined physical activity levels among college seniors, with a particular focus on the transition between college and subsequent employment settings. Participants included 338 college seniors who were randomly assigned to one of two conditions: a physical education course based on empirically supported behavior change concepts or a general health course, each lasting one semester. At the end of the semester, it was found that women in the intervention condition increased their total energy expenditure (total amount of activity), their amount of weight training, and their flexibility relative to controls. However, there were no observed effects for the

men. A 2-year follow-up found no differences in physical activity between the two intervention groups; however, cognitive processes related to motivational readiness for physical activity were significantly improved for women even after 2 years. Although this study did not find any effects for men or any long-term effects on physical activity levels, it did demonstrate long-term success in improving the processes of change for women that have been found to be important predictors of physical activity in other studies.

As previously mentioned in the youth research area, studies on adolescents' and young adults' physical activity levels need further extension into community and ecological settings. Other data have demonstrated that children and adolescents obtain most of their physical activities from afterschool and community programs, such as local youth sports and extramural classes. However, few studies have attempted to employ physical activity interventions in these types of community settings.

#### PHYSICAL ACTIVITY INTERVENTIONS WITH MIDDLE-AGED ADULTS

Interventions targeting middle-aged adults tend to occur in more diverse settings, such as work and health care environments. Sallis and Owen point out that work settings have many advantages that individually based settings (such as home-based studies) may not have for this age group. For example, studies in worksites can reach a large population of adults with a variety of backgrounds, worksites already have usable communication systems and other resources that can be taken advantage of, and worksites usually have a group of staff interested in the health and safety of the workers. In addition, since at least some segments of the population generally work in one place for a while, researchers can often keep in contact with participants for a reasonably long period of time.

Despite these advantages, recent reviews have questioned the success of physical activity intervention studies in worksites. A review by Dishman and colleagues identified 73 studies of various types of worksite fitness or physical activity interventions conducted in a variety of work environments, including corporations, universities, and public agencies. Characteristics of the interventions in these studies were also varied and included health education/risk appraisal, exercise prescription, behavior modification, or a combination of these approaches. Some

studies involved a supervised intervention team where participants met with a member of the research team on a regular basis (either individually or in groups), whereas others used a nonsupervised intervention. Dishman and colleagues conducted a quantitative analysis (meta-analysis) of 26 of these studies. The average age of participants in these studies was generally mid- to late 30s. Their analysis revealed a small positive effect overall for the worksite studies examined. They also found that studies using randomized and controlled experimental designs demonstrated smaller increases in physical activity than studies using less rigorous scientific designs.

Based on their review, Dishman and his colleagues concluded that physical activity interventions at worksites do not appear to be effective in increasing physical activity. One of the reasons cited for this is that people do not tend to use work as a place for exercising. The authors state that future research in worksites should make better use of the resources in the organization. That is, rather than focusing on changing behavior at an individual level, future studies should incorporate a more ecological approach by making use of multilevel designs that incorporate personal, environmental, and organizational factors.

Health care settings also have the advantage of being able to reach a large portion of the population, especially for middle-aged and older adults. In fact, physical activity counseling from physicians has been recommended as part of routine medical care. A few studies have examined the influence of physician advice interventions. Sallis and Owen explained that these studies involve training physicians on how to give brief advice during typical office visits to help people overcome barriers. These studies have demonstrated that even very brief counseling from a physician can have a positive influence on amount of physical activity. Simons-Morton and colleagues conducted a formal review of research in health care settings and identified several factors that influence success in increasing physical activity. These factors included multiple contacts with patients, a behavioral approach, exercise supervision, providing equipment to patients, and long-term follow-ups.

#### PHYSICAL ACTIVITY INTERVENTIONS WITH OLDER ADULTS

In recent years, physical activity interventions with older adults have moved to the forefront of physical



activity research. King and colleagues pointed out that the research in this area has grown because older adults (over 50 years old) are a fast-growing segment of the population, in addition to being among the most sedentary segments of the population. Furthermore, many of the negative health conditions that affect older adults are preventable or controllable with regular physical activity of even a moderate level.

King and colleagues conducted a recent review of studies of physical activity interventions aimed at older adults, which identified 29 studies since 1984 that were community based and employed an experimental or quasi-experimental design. Approximately half of the studies reviewed used a theoretical framework for designing the intervention. This review found that the interventions that were most effective in increasing physical activity were those that used behavioral or cognitive-behavioral interventions rather than those based only on education or instructional-type interventions. These researchers also found that regularly supervised, home-based approaches were generally as or more effective than classroom or group-based formats. In addition, continuing telephone contact with participants was found to be just as effective as in-person contact in maintaining physical activity levels for up to 2 years in this age group.

King conducted a second review of intervention studies with older adults and identified a number of factors that serve as correlates or predictors of physical activity for older adults. These include current level of physical health, age, gender, smoking status, education level, income, and body weight. In addition, one should consider participants' desires to increase physical activity, beliefs about the importance of physical activity, and self-efficacy (i.e., one's perception that one can successfully engage in physical activity if desired). This review also identified several program-related factors that need to be considered. These include physical activity structure (e.g., requiring participants to take classes, encouraging increases in daily walking around one's neighborhood) format (home based, facility based), complexity, intensity, convenience, financial costs, and psychological costs (e.g., embarrassment or self-consciousness in attending an exercise class). In addition, women in particular might benefit more from a social component to the program. Environmental factors that were identified as correlates of physical activity included social support, in which the desired

source of support may depend on the phase of the study (i.e., beginning an exercise routine vs. maintaining). Physician support and ease of access to exercise facilities appear to be important factors to consider as well.

The review by King and colleagues presented four main recommendations for future research in this area. One recommendation is that specific guidelines be developed for older adults regarding how much and what types of physical activity are needed. These guidelines should include strength, flexibility, and balance training. In addition, clearer definitions are needed regarding what exactly moderate and vigorous physical activities are when the target group consists of older adults. A second recommendation is that interventions that have been supported in prior research should be tested in a wider variety of subgroups, including those who are frail or who have chronic conditions or disabilities, ethnic minorities, low-income subgroups, rural elderly, those over age 85, and those who are socially isolated or depressed. A third recommendation is that protocols be developed that health care providers can use to efficiently assess the health status of older adults and recommend physical activity regimens that are more individually tailored to a person's specific needs. Last, these researchers recommend that environmental and policy-level approaches be rigorously studied. Specifically, more information is needed on what types of interventions that include environmental and policy changes would be effective in allowing physical activity to be incorporated more easily into people's daily lives.

## FUTURE DIRECTIONS

As mentioned in the previous sections, there are several directions for further research in the physical activity intervention arena. For example, previous research has identified risks for physical inactivity that are associated with certain demographics, including persons with lower incomes, racial and ethnic minorities, and those with disabilities. People in these groups are less likely to be physically active compared to the general population, and therefore, interventions should be tailored to meet their specific needs. A review by Taylor and colleagues was able to identify 10 studies aimed specifically at various ethnic minority groups, some of which were also low income. The majority of these studies did not employ rigorous

experimental designs, and only two reported reliable, positive changes in physical activity. In general, the 10 studies identified used poor-quality measures of physical activity. Future research with ethnic minority groups should use more rigorous scientific methods and validated measures of physical activity.

The same review identified only four studies conducted with people with disabilities. Each of these studies was conducted with a group that had a specific disability, and each reported increases in physical activity as a result of the intervention. Despite these positive findings, many disabilities have not been studied and will need to be examined in further research.

Another area of research requiring more attention is research on gender differences. As previously discussed, interventions have had mixed results for women and men. For example, a recent nationwide randomized clinical trial called the Activity Counseling Trial (ACT) reported gender differences in response to three physical activity interventions being evaluated. In this study, eligible primary care patients were randomly assigned to either an advice group (physician advice plus written materials), assistance group (physician advice, written materials, plus interactive mail and behavioral counseling), or counseling group (all of the above components plus regular telephone counseling and classes). At the 24-month follow-up, women in the assistance and counseling groups had higher scores on fitness measures than in the advice group. However, there were no differences found for men on either fitness measures or levels of physical activity. It can be concluded from such investigations that men and women likely have different needs regarding the best methods for increasing their physical activity levels.

Most of the interventions discussed in this entry were at the individual or group level. More work is needed in the area of environmental and policy interventions designed to increase physical activity. These types of interventions involve changing the social and physical environments in which people can be active. An example of an environmental intervention is a recent study conducted by Brownson and colleagues that involved examining the influence that walking trails in neighborhoods have on levels of physical activity. However, there have been very few studies at the environmental level.

Within the studies of individuals, there is a need for more intergenerational work. There has been at least one recent study, conducted by Ransdell and

colleagues, that demonstrated some success in getting mothers and daughters to exercise together. Although not all studies involving children and their parents together have been successful, the success demonstrated by this small study should encourage other researchers to engage in larger-scale studies with an intergenerational design. The needs of both the parents and children (as well as, potentially, grandparents) need to be taken into consideration when designing these types of studies.

An additional issue that affects all types of intervention studies is the measurement of physical activity. Guidelines for amounts of physical activity have recently been applied to moderate physical activity. For many individuals, what constitutes "moderate activity" is not as clear and not as easily remembered as bouts of more vigorous physical activity. More work is needed in developing reliable and valid measures of moderate physical activity for all age groups.

Last, new technologies are having an influence on physical activity interventions. Recent research has begun to employ new technologies such as telephone-linked computer systems and Web-based formats for physical activity interventions. Controlled studies are needed comparing these different formats. A major issue for this type of research is ensuring that groups that may not have current ready access to such technologies, but likely will in the future, are included in these studies. It is possible that personality and demographic characteristics may influence receptiveness to these types of intervention formats.

In summary, research with physical activity interventions is making steady progress toward increasing physical activity levels among people of all ages. Many studies discussed above have demonstrated promising results. This entry highlights the need to take into account the optimal setting and channel for the intervention, which may be different for different age groups. Challenges to this area of research for all age groups include accurate measurement of moderate intensity physical activity, use of more environmental and policy-level approaches, further exploration of gender differences, and reaching subgroups of the population at particular risk for inactivity.

—Shannon Q. Hurtz and  
Abby C. King

See also CANCER AND PHYSICAL ACTIVITY; HEART DISEASE  
AND PHYSICAL ACTIVITY; PHYSICAL ACTIVITY AND HEALTH;  
PHYSICAL ACTIVITY AND MOOD

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## PHYSICAL ACTIVITY AND MOOD

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Physical activity is thought to have positive effects on mood and psychological well-being. Many people report feeling better after exercising, although this is by no means universal. It has also been proposed that regular physical activity relieves depression and helps people cope with stress. This entry examines the evidence underlying these claims, summarizing the information that has been obtained from several very different research paradigms. The implications of a favorable effect of physical activity on mood are far reaching, since they are relevant to the well-being of the population at large, the mental health of vulnerable individuals, and the maintenance of long-term adherence to physical activity programs.

## POPULATION STUDIES

A number of cross-sectional population or epidemiological studies have assessed associations between levels of physical activity and mental health. Physical activity has been positively related to general well-being, and negatively associated with anxiety and depression, in representative population samples in several countries. Such associations might be due to the influence of a third factor. For instance, physical illness could lead to reduced physical activity and to poor psychological well-being, and low socioeconomic status is associated both with physical inactivity and with increased levels of mental ill health. However, in a nationally representative sample of 16-year-olds in the United Kingdom, participation in physically active sports and pastimes was found to be negatively associated with distress after adjustment for sex, socioeconomic status, and health. Interestingly, participation in nonactive social pastimes (such as pool and pinball games) was positively related to distress. In old age, maintenance of greater

physical activity is associated with less depression and disability, and greater active engagement with social roles.

Epidemiological methods have also been used to examine relationships between changes in mood and physical activity over time. Much of the evidence indicates that physical activity reduces risk of subsequent depression. Thus, an analysis of the Alameda County, California, population cohort assessed the incidence of new cases of clinical depression over a 5-year period in 1,947 adults varying in physical activity. Greater physical activity at baseline was protective against future depression, after adjusting statistically for age, socioeconomic status, ethnicity, financial strain, chronic health problems, disability, body mass, alcohol, smoking, and social support. The evidence from both cross-sectional and longitudinal population studies therefore indicates that physical activity has a favorable effect on mood and psychological well-being.

#### ACUTE PHYSICAL ACTIVITY

A second source of evidence comes from studies assessing mood before and after individual bouts of physical activity. Do people feel better after they exercise, and if so, for how long? Studies of this issue have used a variety of psychological measures, and physical activity interventions that vary in type (e.g., running, bicycling, swimming), duration, and intensity. While the majority of research has shown positive mood effects after exercise, some investigators have argued that the reductions in anxiety that occur are no greater than those reported after a comparable period of quiet rest. Others have demonstrated transient increases in mental vigor and exhilaration lasting 15 to 20 minutes. There is some evidence that positive mood changes only occur after moderate but not intense exercise, which may lead to extreme fatigue and depressed mood. Investigating this issue is complicated by the fact that measures of mood may be confounded with the physical effects of activity. For example, assessments of states of anxiety typically include ratings of tension and shortness of breath, both of which might be elevated because of recent exertion. Clearly, the impact of physical activity also varies between populations. In trained athletes, the mood effects of activity may be dependent on how they feel they have performed on that occasion, while in a sedentary individual even moderate activity could lead to feelings of exhaustion.

One acute effect of physical activity that has been recorded in several studies is a reduction in physiological stress responsivity. The magnitude of blood pressure and heart rate responses to standardized mental stress tests are attenuated if stress testing is preceded by physical activity. This phenomenon is thought to last for at least 2 hours, but is not well understood. It may be due to neuroendocrine and autonomic nervous system activation during exercise, which blunts subsequent reactivity to stress. People who exercise regularly also report more positive moods at the end of the days on which they are active compared with rest days, and may perceive the minor hassles in their lives as less stressful. These acute effects could contribute to the impact of physical activity on mood and well-being over the longer term.

#### PHYSICAL ACTIVITY INTERVENTION STUDIES

The strongest evidence for the effects of physical activity on mood probably emerges from experimental intervention studies in which sedentary people are randomized to exercise and control conditions, and changes in mood are assessed. Work of this type has been carried out with healthy populations, in samples from the general community with symptoms of depression and anxiety, and in psychiatric populations. The impact of aerobic activity has generally been positive, with increases in positive mood and perceived coping ability together with reductions in anxiety and depression in people randomized to regular physical activity conditions. Depression has been a major focus of this research because of the clinical implications for the management of depressive illness, but the evidence for reductions in anxiety is just as strong. There is less convincing evidence for the influence of anaerobic (resistance) training than for aerobic activity.

However, problems with the design of studies prevent definite conclusions from being drawn. Many studies have been carried out with small samples of 20 to 50 participants. The fact that these individuals choose to take part in research on physical activity may mean that they are not representative of the larger population.

Few studies have used the gold-standard clinical trial intention-to-treat approach to analysis, in which all entrants to studies are analyzed irrespective of whether they completed the trial or dropped out. Since there is often a large drop-out in activity studies, a

further selection bias is introduced; people who complete a trial may benefit psychologically, but those who drop out have probably not felt positive changes and are excluded from the analysis. It could therefore be that positive psychological changes with physical activity only occur in individuals who are predisposed to experience such effects. The duration of physical activity programs has generally been short, with few studies continuing for more than 12 weeks, and follow-ups have been limited.

Another important issue concerns the comparison conditions selected for the study. Unless these are matched with physical activity in terms of level of attention and contact with investigators, the amount of social involvement, and the sense of achievement that arises from successfully completing exercise assignments, then any positive mood changes might be due to these nonspecific factors, rather than more direct mechanisms.

There have been some convincing studies. For example, a comparison of a 4-month course of aerobic exercise, antidepressant treatment, or their combination, was carried out at Duke University with 156 older patients with depressive disorder. All groups showed similar reductions in depression over the treatment period, suggesting that physical activity stimulated similar changes to those produced by pharmacotherapy. Moreover, relapse during the 12 months following treatment was less frequent in the exercise than medication groups. Nonetheless, conclusions about the mood benefits of regular physical activity must remain tentative, not so much because of the accumulation of negative findings, but because of design limitations in much of the research to date.

#### MECHANISMS RELATING PHYSICAL ACTIVITY AND MOOD

The mechanisms underlying the effects of physical activity on mood are not well understood. Most studies of changes in mood following activity programs have found little correlation between cardiorespiratory fitness and psychological responses. This suggests that mood changes are unlikely to be simple effects of improved fitness. An early suggestion was that mood changes were due to increased levels of opioid peptides such as beta-endorphin, but trials using endorphin antagonists such as naltrexone have been inconsistent. Since these antagonists block endorphin responses, they should reduce any positive

mood change with exercise. But when they are administered in a double-blind fashion, so that neither the participant nor the investigator knows whether the active drug or placebo has been given, differences between conditions have been inconsistent. Monoamine neurotransmitters such as dopamine and serotonin may be involved, but convincing evidence from humans is lacking.

As noted earlier, episodes of reduced stress responsivity and enhanced mood follow individual bouts of exercise, so that the person exercising regularly may experience repeated periods of tranquility that could lead over time to generalized positive mood change. Another attractive theory is that the achievement of intermediate physical activity targets (e.g., running half a mile, swimming for 10 minutes) induces changes in self-concept and a sense of mastery that may generalize to heightened self-esteem and enhanced well-being. There are exciting possibilities for future research in teasing out the mechanisms underlying mood changes.

#### CONCLUSIONS

Evidence for a beneficial effect of physical activity on mood has emerged from several complementary types of research. Both cross-sectional and longitudinal epidemiological studies have rather consistently demonstrated that physically active people are less likely to be depressed and have more positive moods than are sedentary individuals. Acutely, exercise leads to enhanced positive mood in some individuals and to reduced postexercise stress responsivity. Intervention trials with sedentary individuals have generally endorsed the favorable effects of activity, but research design limitations prevent definitive conclusions from being drawn. The positive psychological effect of physical activity may be important from the public health perspective. Most of the health benefits of regular activity are long term, and so remain intangible for many years. The effects of activity on mood are more immediate, so they could provide greater short-term reinforcement of exercise habits. Greater attention to mood change may therefore help to sustain active lifestyles.

—Andrew Steptoe

*See also* DEPRESSION: TREATMENT; PHYSICAL ACTIVITY AND HEALTH; PHYSICAL ACTIVITY INTERVENTIONS

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## PLACEBOS AND HEALTH

Placebos are physically inert substances or procedures that are presented to patients in the guise of physically active treatments. Most placebos are capsules or pills that look exactly like the active drug to which they are being compared. However, sham surgery has also been used as a placebo. Placebo surgery involves making an incision and sewing the patient back up, without performing the surgical procedure.

The term *placebo* is Latin and means "I shall please." This reflects the historical use of placebos to placate patients whose complaints could not otherwise be treated. It also indicates a belief that while the placebos might please patients, they are not likely to produce real benefits. The misperception that placebos do not produce real benefits began to change during the 1950s and 1960s, as research revealed genuine changes in patients' conditions following placebo administration. Among the conditions that have been shown to be affected by placebos are asthma (including changes in bronchial constriction and dilation),

pain, anxiety, depression, gastric function (nausea and vomiting), general arousal (including blood pressure and heart rate, as well as subjective reports of arousal), sexual arousal, and skin conditions (contact dermatitis and warts). Besides producing therapeutic benefits, placebos sometimes mimic the side effects of active medications, although to a much lesser degree. The eventual result of the recognition of the placebo effect was the routine use of placebos as control treatments in the evaluation of new medications.

The magnitude of placebo effects varies from condition to condition. For example, placebos duplicate about 80% of the therapeutic benefit of antidepressants and about 50% of the pain-reducing effects of analgesics. The size of the placebo effect can also vary as a function of a number of other factors. For example, placebo capsules are more effective than placebo pills, and placebo injections are more effective than placebo capsules. The strength of the medication to which the placebo is being compared also affects the effectiveness of the placebo. Thus, placebo morphine is more effective than placebo aspirin. Two placebos are more effective than one placebo, and placebos with a recognized brand name are more effective than placebos administered as generic drugs. In general, the effectiveness of a placebo depends on amount of effect that the person expects to experience.

How is it that an inert substance can produce psychological and physical changes? Currently, the two most popular explanations of the placebo effect are classical conditioning and response expectancy. Classical conditioning is a phenomenon discovered by the Russian physiologist Ivan Pavlov, at the beginning of the 20th century. In classical conditioning, a stimulus (called an *unconditional stimulus*) that automatically elicits a response (called an *unconditional response*) is paired repeatedly with a neutral stimulus (called a *conditional stimulus*). After a number of such pairings, the conditional stimulus acquires the capacity to evoke a response (called a *conditioned response*). Generally, the conditional response is the same as the unconditional response, only weaker. In some cases, however, it appears to be the opposite of the unconditional response, in which case it may be referred to as a *compensatory response*.

As applied to placebo effects, conditioning theory posits the following sequence of events. Active medications are unconditional stimuli, and the therapeutic responses they elicit are unconditional responses. The pills, capsules, and injections by means of which the

medications are delivered are conditional stimuli. Because these conditional stimuli are repeated paired with the active medications that produce the therapeutic benefits, they acquire the capacity to elicit these benefits as conditional responses.

Conditioning theory appears capable of explaining many placebo effects, but there are also some problems with this explanation. For one thing, the conditional response to morphine is an increase in sensitivity to pain (i.e., it is a compensatory response). However, the effect of placebo morphine is a reduction in pain sensitivity. Therefore, it cannot be due to classical conditioning. In fact, it seems to override the conditioning effect. Another problem with the conditioning model of placebo effects is that it does not account well for the existence of placebo effect throughout the history of medicine. Most of the substances that were used as medications before the 20th century (e.g., turpentine, crushed glass, worms, spiders, furs, feathers, crocodile dung, lizard's blood, frog's sperm, pig's teeth, rotten meat, fly specs, powdered stone, iron filings, and human sweat) are now recognized to have been placebos. Because they do not automatically produce therapeutic benefits, they cannot have functioned as unconditional stimuli for placebo effects.

Response expectancy theory rests on the discovery that the belief that an automatic subjective response will occur tends to elicit that response. Thus, the anticipation of anxiety makes people anxious, the belief that one will stay depressed forever is very depressing, and the anticipation of changes in pain alters the perception of pain. More generally, subjective experience appears to be due to a mix of external and internal factors. It is shaped partially by external stimuli and partially by the person's beliefs, expectations, and interpretations of those stimuli. As applied to the placebo effect, expectancy theory asserts that placebos produce their effects by changing people's expectations. A placebo antidepressant, for example, leads people to expect a change in their depression, and that expectation makes them feel less depressed. A shortcoming of expectancy theory is that it does not easily account for the physical effects of placebos.

It is important to note that conditioning theory and expectancy theory are not mutually exclusive. Specifically, classical conditioning may be one of the means by which expectancies are altered. Thus, if an active drug (the unconditional stimulus) repeatedly elicits a particular therapeutic benefit (the unconditional

response), it will also lead people to expect that benefit when they think they are taking the drug, and that expectation might produce the placebo effect (the conditional response).

—Irving Kirsch

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## PREGNANCY OUTCOMES: PSYCHOSOCIAL ASPECTS

The outcomes of pregnancy include many different medical and psychosocial effects for mother and infant. Among the most significant are preterm delivery (PTD; birth at less than 37 weeks gestation) and low birth weight (LBW; less than or equal to 2500 grams). Infants born early are more likely to be LBW. The United States has surprisingly high rates of LBW and PTD compared to other nations. In 2001, of births in the United States, 11.9% were PTD and 7.7% were LBW. Both rates show increases in the past decade. LBW and its effects occur disproportionately among African American women. In 2001, of African American births in the United States, 13.1% were LBW compared to 6.7% of non-Hispanic Whites and 6.4% of Hispanics. For PTD, 17.6% of African Americans deliver early, 11.4% of Hispanics, and 10.6% of non-Hispanic Whites. These adverse outcomes occur among African Americans of all socioeconomic levels, not only among those who are poor, although poor women of all ethnicities are at greater risk of poor pregnancy outcomes as well.

The consequences of LBW and PTD include higher rates of infant death and a host of developmental and pediatric health complications. For example, prematurity is the leading cause of death in the first month of life. In addition, prematurity is a major contributor to developmental delays, chronic respiratory problems, and vision and hearing impairment. In addition to these significant developmental and health implications of adverse pregnancy outcomes, medical costs associated with PTD and LBW births are enormous. The average cost of a birth after 37 weeks

gestation in the United States is less than \$5,000 compared to more than \$50,000 on average for infants born preterm, amounting to health care costs of close to \$12 billion per year presently.

Because of the many adverse consequences of LBW and PTD, these outcomes are a high priority in public health and medicine. National health agendas have set goals for reductions in rates of PTD (to 7.6%) and LBW (to 5%) by the year 2010. A greater understanding of the etiology of early birth and of poor fetal growth is sought, as are strategies for prevention. In recent years, we have begun to develop stronger integrative models of the causes of adverse pregnancy outcomes, taking into account psychological, social, cultural, and biological factors, as well as demographic analyses of their etiology.

Medical risk factors such as hypertension, gestational diabetes, a prior PT or LBW delivery, and gynecological infections predict adverse outcomes such as PTD and LBW, but not terribly well. Availability and use of prenatal care throughout pregnancy predict better outcomes; lack of prenatal care contributes to the adverse outcomes of poor women. In addition, behavioral factors such as tobacco use (smoking), alcohol use, and drug use are known risk factors for adverse outcome. However, relatively high rates of LBW and PTD still occur in women who do not use substances. Therefore, attention has turned in recent years to a wide range of further behavioral and psychosocial factors possibly involved. Among these, stress has probably received the greatest attention.

Stress is broadly defined as demands that tax or exceed resources. Stressors are demands such as life events, chronic strain, and trauma. Stress responses include emotional, behavioral, and biological reactions to demands. In pregnancy, the stress variables studied most often are major life events, such as death of a close relative or a family member's job loss, and the emotional state of anxiety. Nearly three dozen studies have been done on stress and PTD alone. The subset of these that are prospective studies with larger samples, standardized measures of stress, and appropriate controls indicate that stress is a significant risk factor for PTD. In a series of studies, Christine Dunkel Schetter and colleagues have found that multidimensional stress measures predict PTD. The component of stress that seems to be most responsible is anxiety. Women who are more anxious *in general* during pregnancy and who are more anxious *about their pregnancies* deliver their babies earlier. These findings

appear to hold true for all ethnic groups, although emerging findings suggest that additional factors such as racism may figure importantly in the etiology of PT birth in African Americans.

Emerging research in several laboratories with human and animal models points to dysregulation of the maternal stress systems in the mediation of the relationship between stressful experience and early onset of labor. Acute stress elicits a cascade of biological responses involving many systems including the cardiovascular system, the endocrine system, the immune system, and the nervous system including the brain. Complex responses to stress that occur in humans in response to stress are well understood and provide a basis for our growing knowledge of stress in pregnancy. One feature that differs is that the fetus and the placenta both release stress hormones such as corticotropin-releasing hormone (CRH) in response to specific maternal stress hormones. High levels of maternal stress hormones such as cortisol and CRH have been implicated in PTD via their effects on the placenta and the fetus. Although the pathways and precise mechanisms are not fully worked out as yet, it appears that psychosocial stress and emotions in the mother can lead to physiological effects that influence the timing of delivery and in some cases, trigger early delivery. In addition, emerging research suggests effects of maternal stress on fetal development and on the offspring's health over the life span.

In addition to the fast-growing body of work on maternal stress and pregnancy outcomes, other findings point to personal resources such as a woman's degree of mastery, optimism, self-esteem, and social support in predicting fetal growth. Women who lack these resources are at higher risk of delivering an LBW infant, independent of the timing of delivery. In addition, recent results suggest that perceived racism and rumination over severely stressful life events among African American pregnant women predict LBW independent of their level of education, income, and medical risk. There is some evidence that these links are mediated by behavioral health factors such as substance use, lack of prenatal care, inactivity, and poor diet. However, this topic requires much further investigation before we will fully understand the risk factors and pathways.

It remains to be known whether there are vulnerable times in pregnancy such as the first trimester when stress may have its most potent effects. Some



evidence points to critical times in early pregnancy. Further evidence points to prepregnancy states of the mother such as emotional stability and her family history of stress and birth as potent risk factors. Both prenatal risk factors and prepregnancy risk factors hold promise for future interventions that reduce rates of LBW and PTD.

There have been very few randomized, controlled trials testing psychosocial interventions in pregnancy in order to prevent LBW or PTD. A number of social support interventions have been tested but only one or two have been found effective. For example, Jane Norbeck and her colleagues in San Francisco targeted a group of low-income African American women who had inadequate social support and intervened to reduce LBW in this group by use of individual counseling sessions in which problems and successes in life were identified and meaning, self-esteem, and social support were bolstered. This intervention successfully reduced LBW by 13% from 22% in the control group to 9% in the intervention group. This study is promising although methodological limitations hinder our ability to draw strong conclusions about most interventions as yet.

Future directions include (1) the further development and refinement of theories of the etiology of PTD and LBW that combine biological, psychological, sociocultural, and medical knowledge, and (2) the development of intervention trials that are based in theory and, importantly, that test process variables allowing researchers to infer what the mechanism of effective interventions are.

—Christine Dunkel Schetter  
and Christine M. Rini

See also PREGNANCY PREVENTION IN ADOLESCENTS

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## PREGNANCY PREVENTION IN ADOLESCENTS

### CURRENT STATISTICS ON ADOLESCENT PREGNANCY

Adolescent pregnancy includes women between the ages of 10 and 19 who conceive and give birth to children. Statistical data, based on recorded birth certificates from state vital statistics offices, are used to calculate the teen pregnancy rate. Adolescent pregnancy rates are compiled and distributed through the Center for Health Statistics and the Centers for Disease Control and Prevention (CDC, 2003). These data are often looked at by categories of ages: 10-14, 15-19, and 18-19. Age categories have been shown to reflect certain risk factors that can be anticipated due to a young woman's age and point of development, and predict deleterious health, social, and economic effects. Younger adolescents ages 10-14 show the greatest risk factors. Pregnant adolescents, under the age of 15, for example, have higher rates of complications and more premature and low-birth-weight babies than older mothers.

Vital statistics also offer information on adolescents who are married and not married at the time of the birth of their children. Marital status is important in relation to the incidence of adolescent births as well as the sociopolitical and moral debates about adolescent pregnancies.

### Adolescent Birth Rates

The overall adolescent birth rate has fallen since the 1950s. There was a sharp increase in the birth rate in the 1980s, followed by a continuous decrease in the 1990s. Statistical data from the Center for Health Statistics indicate that birth rates for adolescents were at a historic low in 2001 (CDC, 2003). There were 45.3 births per 1,000 women ages 15-19, down 5% from 2000 and 24% lower than in 1990. For young adolescents ages 10-14, the rate per 1,000 women was 0.8; that figure was 8% lower than in 2000 and 34% lower than in 1990. For older adolescents ages 18-19, pregnancy rates were 76.1 per 1,000; that figure was down 3% from 2000 and 14% from 1990.

The U.S. teen birth rate remains the highest among developed countries. According to the latest data available, the rate is lowest in Japan at about 4 births per 1,000 women and is below 10 per 1,000 in a number of countries, including Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden, and Switzerland.

Births to adolescents also vary a great amount based on race and ethnicity. Non-Hispanic Whites had a birth rate of 30.3 per 1,000 in 2001, non-Hispanic Blacks had a birth rate of 73.5 per 1,000, Native Americans had a birth rate of 56.3 per 1,000, Asian/Pacific Islanders had a birth rate of 19.8 per 1,000, and Hispanics had a birth rate of 86.4 per 1,000. Hispanics clearly have the highest birth rates of any group.

### Increase in Births to Unmarried Adolescents

Despite the fact that the overall birth rates of adolescent women have decreased for 50 years, the proportion of unmarried adolescents who have children has continued to rise, from 14% in 1940 to 67% in 1990 and 79% in 2000 (CDC, 2001). These data are keeping alive an ongoing public debate about the unacceptability and the social problem of adolescent childbearing. Recent data from Child Trends (2001) indicate that 22% of births to unmarried adolescents are repeat (second or subsequent) childbirths. As the vital statistics indicate, however, an increase in unmarried teen pregnancy is not due to an overall increase in births to adolescents; rather, it is because fewer and fewer adolescents who give birth are married. This occurrence of unmarried adolescent

pregnancies follows a broader social trend for women of all ages. Adolescent pregnancy, for example, accounts for only 28% of all unmarried pregnancies to women. This shows that the trend of giving birth outside of marriage is much larger for adult women than for adolescent women.

### WHY IS ADOLESCENT PREGNANCY CONSIDERED A PROBLEM?

Pregnancy is not a disease to be prevented but a normal condition for females of childbearing ages who are sexually active and do not use contraceptives (Franklin, Corcoran, & Harris, in press). Adolescent pregnancy would not be a problem except that the pregnancy occurs in a certain social and developmental context that produces harmful or unwanted outcomes for herself and others. The social and developmental context of adolescent pregnancy, for example, is usually believed to be accompanied by negative and adverse health, social, and economic consequences for the young woman and her child. Many of these consequences, however, are intricately intertwined with the social and economic circumstances of adolescent women who are poor and who are also single parents or bear children outside of marriage. Poverty causes some researchers to question the social and economic validity of the core issues that are discussed as problems produced by adolescent pregnancy. It could be, for example, that the health, social, and economic problems associated with adolescent pregnancy would exist for these young women, even if they were not pregnant, because they are poor and lack education, resources, and skills.

### PUBLIC FOCUS ON ADOLESCENT PREGNANCY PREVENTION

Public policies and concerns for adolescent pregnancy have focused mainly on pregnancy prevention. Most public debates center on moral and economic positions against childbirth to unwed, economically dependent, adolescent women. Public concerns against unwed pregnancy focus attention on the specific risk factors associated with adolescent pregnancies and the need for pregnancy prevention because of known health and social risks to the adolescent mother and her child. Public policies and pregnancy prevention programs focus on reducing risk factors associated with adolescent pregnancies, and on

specific interventions for improving protective factors for vulnerable adolescent populations.

### Health Factors

Obstetric health risks to adolescent mothers include such conditions as toxemia, anemia, cephalopelvic disproportion, and hypertension. Adverse health risks to the child include low birth weight, prematurity, and infant mortality. These conditions are probably overattributed to the physiologic immaturity of the adolescent. Sociodemographic factors, such as low socioeconomic status (SES), single status, and poor prenatal care, have confounded earlier studies in this area. When adolescents receive good medical care their risk for negative health outcomes substantially decreases. Ongoing relationships with health professionals, such as visiting nurses, have also been shown to reduce the repeat pregnancies of adolescents and to produce overall favorable impacts on the adolescent mother's health outcomes. The greatest health risks appears to be among adolescents who are 15 years of age or younger, because young pregnant adolescents may deny or conceal their condition, thus delaying health care.

### Family Factors

Family composition and relationship functioning act as both determinants and protective factors against adolescent pregnancy. Adolescents from single-parent homes are sexually active at earlier ages than are those from two-parent families (see Corcoran, Franklin, & Bennett, 2000, for a review). Parental supervision and monitoring show positive results as a protective function as does explicit disapproval of sexual activity from parents, especially when it occurs in the context of a close mother-daughter relationship.

### Socioeconomic Factors

Low SES has long been established as a significant contributing factor to premature pregnancy (Corcoran et al., 2000). Conversely, high SES is associated with low childbearing rates. Societal attitudes and the differences between education, income, and other opportunities are often used to explain differences in early childbearing among socioeconomic levels. Academic achievement and positive school experiences act as protective factors to prevent pregnancy. Research has

shown that career and academic development are linked to the prevention of pregnancy.

### Peer Group Factors

Peer group attitudes and behaviors influence an adolescent's decision to take on parenting at a young age. A large majority of girls say they received pressure from boys and other girls to be sexually active. Many girls reported being afraid of losing their boyfriends if they refused sex (Franklin et al., in press).

### Religious Factors

Most of the research indicates that commitment to a religion acts as a protective factor against early sexual activity. Placing a high importance on religion and prayer, as well as attendance at parochial schools, appears to serve as a protective factor to the early onset of sexual intercourse (Franklin et al., in press).

### Social Support Factors

Several risk factors for adolescent pregnancy have been shown in studies to be positively affected by providing adequate social support to adolescents: (1) birth weight, (2) maternal adjustment, (3) parenting behavior, (4) child development knowledge, (5) infant health outcomes, (6) family relationships, and (7) maternal satisfaction with pregnancy and prenatal and postpartum health care seeking (Franklin et al., in press).

### Individual Psychological Factors

Substance use, sexual abuse, repeat pregnancies, and lack of academic achievement are the individual attributes most associated with risk for adolescent pregnancy (Franklin & Corcoran, 1999). Personal distress, social role conflicts (i.e., being a student and a mother), developmental crisis (i.e., still being a child and not being prepared for the demands of raising a child), and depression are also evident in pregnant and parenting adolescents. Adolescent pregnancy causes an emotional and situational crisis for young girls but does not appear to be associated with any particular psychological profile or disorder. Behavioral disorders can increase the risk for early sexual behavior in adolescents, but overall individual psychological attributes, such as self-esteem, do not predict pregnancy.

## EFFECTIVE INTERVENTIONS FOR PREGNANCY PREVENTION

In 1997, Franklin, Grant, Corcoran, O'Dell, and Bultman performed a meta-analysis of 32 primary pregnancy prevention outcome studies. Three outcome variables—sexual activity, contraceptive use, and pregnancy rates—were included and analyzed as three separate and independent meta-analyses. Eleven moderator variables (e.g., age, gender, ethnicity) also were examined in relationship to the findings. These authors compared community-based versus school-based interventions and included in their study both clinic and no-clinic programs. The majority (approximately 80%) of the participants in the 32 adolescent pregnancy prevention programs evaluated in the meta-analysis were female youths from African American and Hispanic cultures.

Results indicated that the pregnancy prevention programs examined in the studies had no effect on the sexual activity of adolescents. Sufficient evidence was found, however, to support the efficacy of pregnancy prevention programs for increasing contraceptive use. A smaller but significant amount of evidence also supported program effectiveness in reducing pregnancy rates. Contraceptive knowledge building and distribution was found to be the most effective intervention for increasing contraceptive use and reducing pregnancy rates among adolescents. Moderator analysis showed that younger teenagers (under age 14) have higher pregnancy rates and do not perform as well on contraceptive use measures as older teenagers (age 15 and older).

A more recent narrative review of effective programs conducted by Kirby (2001) recommends several multicomponent programs targeting both sexuality and youth development activities. The Children's Aid Society program known as the Carrera program has been shown to reduce pregnancies for as long as 3 years, for example. Carrera is an expensive, comprehensive program that includes several types of interventions that are offered in combination with one another over time: (1) family life and sex education, (2) individual academic assessment and preparation for standardized tests and college prep exams, (3) tutoring, (4) self-expression activities through the use of the arts, and (5) comprehensive health and mental health care.

Several evidenced-based curricula for preventing adolescent pregnancy are also available for practitioners

to use with adolescent groups. These curricula have clearly written manuals and materials and have been found to be effective in one or more experimental and quasi-experimental studies on pregnancy prevention. Some of the curricula have been widely tested in numerous studies and found to be effective.

Finally, experimental studies indicate that brief pre- and postnatal interventions and prolonged contacts and education with mothers after childbirth had substantive impacts on rapid, repeat childbearing. Interventions, such as nurse visitation in the home and ongoing educational classes, were found effective for decreasing rapid, repeat childbearing (Seitz & Apfel, 1999). Harris and Franklin (in press) also found that a brief, strengths-based, cognitive-behavioral group, "The Taking Charge" curriculum, delivered in a school setting was effective in helping pregnant and parenting adolescents improve school performance, increase problem-solving skills, and remain in school.

—Cynthia Franklin, Jacqueline Corcoran,  
and Mary Beth Harris

See also PREGNANCY OUTCOMES: PSYCHOSOCIAL ASPECTS

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## PSYCHONEUROIMMUNOLOGY

Psychoneuroimmunology is the study of the interactions between brain, behavior, and the immune system. This field has developed from scientific information that the immune system does not operate autonomously. Rather, there are bidirectional communication pathways between the immune system and central nervous system with each having regulatory influences over the other. The presence of these neural-immune interactions provides the basis for the impact of behavioral and psychological factors on immunity and immune-mediated diseases. Conversely, given the ability of immune cell products to alter neural function, immune processes can affect behavior and emotion.

### IMMUNE SYSTEM

The immune system is the body's defense against invading external pathogens such as viruses and bacteria and from abnormal internal cells such as tumors. Innate immunity refers to the body's resistance to pathogens that operates in a nonspecific way without recognition of the different nature of various pathogens, whereas specific immunity is acquired in response to the identification of non-self molecules called antigens. Macrophages and granulocytes are examples of nonspecific immune cells that react to tissue damage by consuming debris and invading organisms. Natural killer (NK) cells are another example of nonspecific immunity that acts to kill virally infected cells in a nonspecific way without need for prior exposure or recognition. In contrast, each T cell or B cell is genetically programmed to attack a specific target by secreting antibodies (B cell) or by killing cells of the body that harbor a virus (T cell).

Both innate and specific immunity are orchestrated by the release of interleukins or cytokines from immune cells; cytokines are protein "messengers" that regulate the immune cells. This cytokine network aids in the differentiation of the immune response and in the coordination of its magnitude and duration. For example, there are two main classes of cytokines secreted by the T cells. One class of cytokines, T helper type 1 (Th1) cytokines, supports T cell responses (e.g., the ability of T cells to kill virally infected cells), whereas another class of cytokines, T helper type 2 (Th2), supports an antibody-mediated humoral immune response. However, the immunoregulatory processes cannot be fully understood without taking into account the organism and the internal and external milieu in which innate and specific immune responses occur.

### BIOLOGICAL CONNECTIONS BETWEEN THE CENTRAL NERVOUS SYSTEM AND IMMUNE SYSTEM

#### Autonomic Nervous System

The central nervous system and the immune system are linked by two major physiological systems, the hypothalamic-pituitary-adrenal (HPA) axis and the autonomic nervous system composed of sympathetic and parasympathetic branches. The sympathetic nervous system (SNS) is a network of nerve cells running from the brain stem (i.e., the phylogenetically "older" part of the brain that runs the body's physiological systems) down the spinal cord and out into the body to contact a wide variety of organs including the eyes, heart, lungs, stomach and intestines, joints, and skin. In organs where the immune system cells develop and respond to pathogens (e.g., bone marrow, thymus, spleen, and lymph nodes), sympathetic nerve terminals make contact with immune cells. Thus, sympathetic release of norepinephrine and neuropeptide Y, together with receptor binding of these neurotransmitters by immune cells, serve as the signal in this "hard-wire" connection between the brain and the immune system. In addition, sympathetic nerves penetrate into the adrenal gland and cause the release of epinephrine into the bloodstream, which circulates to immune cells as another sympathetic regulatory signal.

Many immune system cells change their behavior in the presence of neurotransmitters. Under both laboratory and naturalistic conditions, sympathetic

activation has been shown to suppress the activity of diverse populations of immune cells including NK cells and T lymphocytes. In contrast, other aspects of the immune response can be enhanced. For example, catecholamines can increase the production of antibodies by B cells and the ability of macrophages to release cytokines and thereby signal the presence of a pathogen. Additional studies indicate that sympathetic activation can also shunt some immune system cells out of circulating blood and into the lymphoid organs (e.g., spleen, lymph nodes, thymus) while recruiting other types of immune cell into circulation (e.g., NK cells). In general, SNS activation can reduce the immune system's ability to destroy pathogens that live inside cells (e.g., viruses) via decreases of the cellular immune response, while sparing or enhancing the humoral immune response to pathogens that live outside cells (e.g., bacteria). Together, these observations are a cornerstone for understanding fundamental, neuroanatomic signaling between the autonomic nervous and immune systems.

### Neuroendocrine Axis

The other way in which the brain can communicate with the immune system is via the HPA system. This process begins in the hypothalamus, an area of the brain that governs basic bodily processes such as temperature, thirst, and hunger. Following the release of neuroendocrine factors from the brain, the endocrine glands secrete hormones into the circulation, which reach various organs and bind to hormone receptors on the organs. Under conditions of psychological or physical stress, for example, the hypothalamus increases its release of corticotropin-releasing hormone (CRH) into a small network of blood vessels that descends into the pituitary gland. In response to CRH, the pituitary gland synthesizes adrenocorticotrophic hormone (ACTH), which travels through the bloodstream down to the adrenal glands and triggers the release of a steroid hormone called cortisol from the outer portion of the adrenal glands. Cortisol exerts diverse effects on a wide variety of physiological systems, and also coordinates the actions of various cells involved in an immune response by altering the production of cytokines or immune messengers. Similar to sympathetic catecholamines and neuropeptide Y, cortisol can suppress the cellular immune response critical to defending the body against viral infections. Indeed, a synthetic analog of cortisol is often used to

suppress excessive immune system responses (e.g., in autoimmune diseases such as arthritis, or allergic reactions such as the rash produced by poison oak). Cortisol can also prompt some immune cells to move out from circulating blood into lymphoid organs or peripheral tissues such as the skin. Even more remarkable about the interactions between the neuroendocrine and immune systems is that immune cells can also produce neuroendocrine peptides (e.g., endorphin, ACTH), which suggests that the brain, neuroendocrine axis, and immune system use the same molecular signals to communicate with each other.

### Central Modulation of Immunity

Together, this converging evidence of brain-immune system interactions legitimizes the possibility that the brain has a physiological role in the regulation of immunity. Indeed, one key peptide involved in integrating neural and neuroendocrine control of visceral processes is CRH, and release of this peptide in the brain alters a variety of immune processes including aspects of innate immunity, cellular immunity, and in vivo measures of antibody production. Peripheral immune measures also change following lesioning of the brain (e.g., hypothalamus) or in response to the stimulation of certain brain regions. The brain controls immune cells in lymphoid tissue in the same manner it controls other visceral organs, namely, by coordinating autonomic and neuroendocrine pathways; when these pathways are blocked by specific factors that bind to sympathetic or hormone receptors, the effects of CRH or brain stimulation on immune function is also blocked.

### BEHAVIORAL AND PSYCHOLOGICAL INFLUENCES ON IMMUNITY

Given that psychological responses are expressed in neural activity with accompanying changes in neuroendocrine and autonomic function, it is not surprising that behaviors and emotions are capable of altering immunity. One seminal example is classical conditioning of immune responses. Conditioned immune responses have also been found to retard disease progression in an animal model of autoimmune disease. In the clinical setting, immunosuppressive conditioning occurs in cancer patients who receive chemotherapeutic drugs, and conditioning processes are thought to contribute to biological effects of placebo.

*Stress and immunity, animals.* Considerable evidence has shown that stress can influence health outcomes, and this general concept has led to evaluation of the impact of experimental stressors on immunity. In animals, acute administration of stressors produces alterations of immunity that cannot be accounted for by the physical effects of the stress. Psychological components such as conditioned fear and uncontrollability induce altered immunity, and these effects are related in a dose-dependent manner to the severity of the stressor. Almost every component of the immune system has been found to respond to stress. Stressors (e.g., electric shock, social defeat, restraint, handling, maternal separation) decrease specific and nonspecific cellular immune responses and produce a shift in the expression of regulatory cytokines from those that drive cellular responses (e.g., Th1 cytokines) to those that enhance humoral immunity (e.g., Th2 cytokines). Stress can also alter the migration and distribution of immune cells between compartments in which decreases of immune function in one compartment (e.g., peripheral blood) may lead to increases in another area of the body (e.g., skin), through SNS-induced changes in expression of adhesion molecules on lymphocyte and vascular endothelium; adhesion molecules allow the immune cells to stick to the vessel wall and begin to move from the peripheral blood into the bodily tissues. Thus, conclusions that stress suppresses or enhances immune function with effects on immune competence must be interpreted in light of the high level of redundancy of the immune system and the ability of the immune system to compensate for changes in any one aspect.

*Acute stress and immunity, humans.* Acute laboratory stressors (e.g., mental arithmetic, public speaking, physical exercise) produce profound and rapid changes in the immune system due to the redistribution of immunoregulatory cells from lymphoid organs such as the spleen into the vascular space. Increases of NK cell activity, for example, follow increases in the number of NK cells in the circulation, whereas stress-induced decreases of lymphocyte proliferation are related to shifts in the relative number of T helper to T suppressor lymphocytes. Blockade of the adrenergic receptor attenuates the acute immunologic effects of stress, suggesting that sympathetic activation underlies these processes possibly through effects on adhesion molecule expression. Individuals who are aged or are undergoing chronic stress show exaggerated

responses to acute stress and are likely to take longer to recover from the administration of stress consistent with the notion that the effects of chronic stress accumulate with age and this “wear and tear” or “allostatic load” produces a dysregulation of the body’s ability to respond to stress.

*Chronic stress, depression, and immunity.* In contrast to the effects of laboratory stress, chronic or naturalistic stressors such as bereavement, examination stress, or caregiving are associated with reliable decreases of cellular and innate immunity. A similar pattern of immune alterations is reported in patients with major depression, which is not surprising as individuals undergoing stress often report negative emotions and depressive symptoms and the presence of such affective symptoms is associated with greater immune alterations. When depressive symptoms resolve, a normalization of natural and cellular immune function occurs. Extension of these nonspecific immune findings to disease-specific immune measures has received recent attention, and both depressed and stressed persons show declines of cellular response to varicella zoster virus (i.e., shingles) and impairments in responses to vaccines including influenza, pneumococcal, and hepatitis B. Conversely, writing about a traumatic experience ameliorates emotional stress and increases antibody responses to hepatitis immunization.

*Role of moderating variables.* Heterogeneity in the effects of stress and depression on immunity can be accounted for by a number of factors such as age, gender, ethnicity, health behaviors (e.g., smoking, alcohol consumption), and coping or personality. Older adults show declines in cellular immunity, and the presence of comorbid depression, and possibly stress, further magnifies age-related immune alterations. Gender of the subject exerts differential effects on pituitary-adrenal and immune systems by modulating the sensitivity of target tissues, and women show exaggerated expression of cytokines that lead to inflammation. Such inflammatory responses to stress may place women at increased risk for autoimmune disorders. In contrast, declines of T cell and NK cell response appear to be more prominent in depressed men than depressed women. In regard to ethnicity, African American ethnicity interacts with a history of alcohol consumption to exacerbate immune abnormalities; alcohol dependence is associated with decreases of NK and cellular immune responses with a shift toward

Th2 cytokine response. Moreover, depressed patients who are comorbid for alcohol abuse or tobacco smoking show exaggerated declines of NK activity.

Other personal characteristics, such as coping and personality, that moderate neuroendocrine and sympathetic activity contribute to individual differences of immune responses to psychological stress. For example, coping and personality characteristics influence people's perceptions of external events, and it is the perception of stress (rather than the event itself) that triggers physiological stress responses by the sympathetic nervous system or HPA axis. To some extent, these effects are moderated by social factors in which social support is associated with immune enhancement, whereas disruption of social relationships (e.g., bereavement, divorce, feelings of loneliness) leads to down-regulation of certain immune parameters. Furthermore, psychosocial interventions designed to reduce distress, increase adaptive coping, and provide social support can improve NK and cellular immune responses.

### SLEEP, CYTOKINES, AND IMMUNITY

Disordered sleep and loss of sleep are thought to adversely affect resistance to infectious disease, increase cancer risk, and alter inflammatory disease progression. Animal studies show that sleep deprivation impairs influenza viral clearance and increases rates of bacteremia. In humans, normal sleep is associated with a redistribution of circulating lymphocyte subsets, increases of NK activity, increases of certain cytokines (e.g., IL-2, IL-6), and a relative shift toward Th1 cytokine expression that is independent of circadian processes. Conversely, sleep deprivation suppresses NK activity and IL-2 production, although prolonged sleep loss has been found to enhance measures of innate immunity and proinflammatory cytokine expression. In clinical populations who show disordered sleep (e.g., depression, bereavement, alcoholism), alterations of natural and cellular immune function coincide with sleep loss and disturbances of sleep architecture. Decreases of sleep time and/or increases of rapid eye movement (REM) or "dream" sleep are associated with increases in the nocturnal and daytime expression of IL-6, possibly with consequences for daytime fatigue.

Bidirectional actions of cytokines on sleep have also been identified. In animals, cytokines have both somnogenic and inhibitory effects on sleep depending

on the cytokine, plasma level, and circadian phase. In humans, much less is known about the sleep regulatory effects of cytokines. Expression of the Th2 or anti-inflammatory cytokine IL-10 prior to sleep predicts amounts of delta sleep during the nocturnal period. In contrast, peripheral administration of the proinflammatory cytokine IL-6 reduces delta sleep, and nocturnal levels of both IL-6 and TNF temporally correlate with increases of REM sleep, particularly during the late part of the night.

### CYTOKINES' INFLUENCES ON THE CENTRAL NERVOUS SYSTEM AND BEHAVIOR

Not only does the brain participate in the regulation of immune responses, but the central nervous system receives information from the periphery that an immune response is occurring with consequent changes in both electrical and neurochemical activity of the brain. During immunization to a novel protein antigen, the firing rate of neurons within the brain (e.g., ventromedial hypothalamus) increases at the time of peak production of antibody; this part of the brain controls autonomic activity. Cytokines released by immune cells are increasingly implicated as messengers in this bidirectional interaction, and the release of IL-1 following activation of macrophages with virus or other stimuli induces alterations of brain activity and changes in the metabolism of central brain chemicals and neurotransmitters such as norepinephrine, serotonin, and dopamine in discrete brain areas. Much recent data have focused on how these cytokines signal the brain given their large molecular size and inability to cross readily the blood-brain barrier. It is now known that IL-1 and possibly other inflammatory cytokines communicate with the brain by stimulating peripheral nerves, such as the vagus, that provide information to the brain. In sum, the immune system acts in many ways like a sensory organ, conveying information to the brain that ultimately regulates neuroendocrine and autonomic outflow and the course of the immune response.

Immune activation leads to changes of peripheral physiology and behaviors that are similar to a stress response. With peripheral immune activation, proinflammatory cytokines are expressed in the central nervous system, CRH is released by the hypothalamus, and there is an induction of a pituitary-adrenal response and autonomic activity. Coincident with these physiological changes, animals show reductions



in activity, exploration of novel objects, social interactions, food and water intake, and a willingness to engage in sexual behaviors. Taken together, this pattern of behavioral changes (i.e., sickness behaviors) is similar to that found in animals exposed to fear or anxiety-arousing stimuli, and can be reproduced by the central or peripheral administration of IL-1. In contrast, central administration of a factor that blocks IL-1 antagonizes these effects. These cytokine-brain processes are also implicated in increased sensitivity to pain stimuli that is found following nerve or tissue injury.

Human studies have begun to reveal links between peripheral cytokines and behavioral changes. Associations between cytokines and sleep have recently been extended to measures of daytime fatigue. In cancer survivors, the occurrence of fatigue is associated with increases of proinflammatory cytokines. Large doses of cytokines, given as immunotherapy for cancer or hepatitis C, frequently induce depression-like symptoms such as depressed mood, inability to experience pleasure, fatigue, poor concentration, and disordered sleep, which can be effectively treated by giving antidepressant medications. Finally, physiological activation of the immune system by bacterial products with the release of proinflammatory cytokines leads to increases of depressed mood and anxiety and decreases of verbal and non-verbal memory functions.

#### CLINICAL IMPLICATIONS OF PSYCHONEUROIMMUNOLOGY

The factors that account for individual differences in the rate and severity of disease progression are not fully understood, although increasing evidence suggest that behavior and multisystem physiological changes that occur during depression or stress come together to exacerbate the course of many chronic diseases. In the following sections, several pertinent disease examples are presented in relation to relevant psychoneuroimmunology processes.

##### Cardiovascular Disease

Atherosclerosis is now thought to be an inflammatory process that involves a series of steps, each of which appears to be affected by stress and/or depression (Coe & Lubach, 2003; Dantzer, 2001; Sanders & Straub, 2002). Activated macrophages within the

vascular secrete proinflammatory cytokines, which, in turn, leads to expression of adhesion molecules. With recruitment of immune cells to the vascular cell wall or endothelium and the release of inflammatory cytokines, the vascular endothelium expresses adhesion molecules that facilitate further binding of immune cells. Importantly, psychological and physical stressors increase both release of proinflammatory cytokines and expression of adhesion molecules that tether ("slow down") and bind immune cells to the vascular endothelium. Moreover, it appears that depression is associated with activation of the endothelium. Acute coronary patients who are depressed show an increased expression of an adhesion molecule that is released following activation of the vascular endothelium (i.e., soluble intracellular adhesion molecule). Importantly, this molecular marker of endothelial activation, as well as IL-6, predict risk of future myocardial infarction.

##### Infectious Disease Risk

Compelling evidence has shown that inescapable stress, a putative animal model of depression, increases susceptibility to viral diseases such as herpes simplex, influenza, and Coxsackie virus infections via alterations in immune function. In humans, prospective epidemiological studies and experimental viral challenge studies show that persons reporting more psychological stress have both a higher incidence and a greater severity of certain infectious illnesses such as Epstein-Barr virus infections and the common cold. In most studies, immune correlates were not obtained although stress-related increases of IL-6 temporally predict greater symptom severity in persons inoculated with influenza A. Moreover, experimental vaccinations have been used as a probe to examine the disease-specific and integrated in vivo action of the immune system in relation to psychological stress.

Substance and alcohol dependence also increases the risk of infectious disease, possibly through effects on neuroimmune pathways. Chronic alcohol use is associated with decreases of NK cell responses and cytokine-stimulated NK activity, decreased cellular immunity, and a relative shift toward a Th2 cytokine response. The incidence and severity of tuberculosis, hepatitis C, and possibly HIV infection is increased in alcoholics, and further data show that exaggerated expression of the Th2 cytokine IL-10 prospectively

predicts infectious disease complications in alcoholics recovering from surgery. Likewise, cocaine dependence is associated with an increase in the incidence and severity of HIV disease progression and hepatitis C seroconversion, which is thought to be driven by the pharmacological effects of cocaine on proinflammatory and Th1/Th2 cytokine expression and HIV replication.

## HIV

HIV infection shows a highly variable course, and psychoneuroimmunology (PNI) relationships appear to play a significant role in influencing the rate of HIV disease progression across patients. Depression, bereavement, and maladaptive coping responses to stress (including the stress of HIV infection itself) have all been shown to predict the rate of immune system decay in HIV patients. Immune system decline and HIV replication are particularly rapid in patients living under chronic stress (e.g., gay men who conceal their homosexuality) and in patients with high levels of SNS activity (e.g., socially inhibited introverts). Tissue culture studies have shown that SNS neurotransmitters and glucocorticoids can accelerate HIV replication by rendering T lymphocytes more vulnerable to infection and by suppressing production of the antiviral cytokines that help cells limit viral replication. Current research is focusing on pharmacological strategies to block the effects of stress neuroendocrine hormones on chronic viral infections such as HIV.

## Stress, Depression, and Rheumatoid Arthritis: Neuroimmune Mechanisms

In a negative feedback loop, proinflammatory cytokines stimulate the HPA axis that results in the secretion of glucocorticoids, which, in turn, suppresses the immune response. However, in autoimmune disorders such as rheumatoid arthritis, it is thought that the counterregulatory glucocorticoid response is not fully achieved. In animals that are susceptible to arthritis, there is a central hypothalamic defect in the biosynthesis of CRH, blunted induction of ACTH and adrenal steroids, and decreased adrenal steroid receptor activation in immune target tissues, which together contribute to weak HPA response, one that is not sufficient to suppress the progression of an autoimmune response. Rheumatoid arthritis patients also show a relative hypofunctioning of the HPA axis despite the degree of inflammation. Stress and

depression can lead to HPA axis activation and to increases of proinflammatory cytokines, and recent data suggest that stressful events, particularly those of an interpersonal nature, provoke symptoms of disease such as greater pain and functional limitations. Moreover, the presence of depression in rheumatoid arthritis patients undergoing stress is associated with exaggerated increases of IL-6, a biomarker predictive of disease progression. Conversely, administration of a psychological intervention that decreases emotional distress produced improvements in clinician-rated disease activity in rheumatoid arthritis patients, although immunologic mediators were not measured. Likewise, in the case of another autoimmune disorder, psoriasis, a stress reduction intervention, mindfulness meditation, was found to induce a more rapid clearing of the psoriatic lesions.

## Cancer and PNI

Experimental studies conducted in animal models have shown that exposure to acute stress leads to decreases in NK cell function and facilitates the metastatic spread of NK-sensitive tumors. However, establishing the links between psychological factors, changes in the immune system, and the development and progression of cancer in humans has been more challenging. Stress, distress, and lack of social support are associated with changes in the immune system and related physiological systems in cancer patients. In addition, there is some evidence that these and other psychological factors are linked to disease outcomes, such as recurrence and survival. In metastatic breast cancer patients, group psychotherapy led to improvements in mood and increased survival time, controlling for initial staging and medical care during the follow-up period. Among patients with malignant melanoma, group psychotherapy was associated with decreases in distress, increases in active coping, and increases in NK cytotoxicity, as well as a higher rate of survival. Both baseline NK cytotoxicity and improvements in coping behavior were associated with disease outcomes in this study.

Although these results are compelling, research linking psychological variables to cancer onset and progression are inconsistent, and the role of the immune system in mediating any psychological effects on disease course is not established. Interactions between tumors and the immune system are complex and vary depending on the type of cancer

as well as the stage of disease. The importance of the immune system in regulating the most common human tumors, such as breast and prostate cancer, is not fully defined. In addition, immunogenic tumors have rarely been investigated in PNI studies. Other physiological systems, such as the endocrine, may also play a role; for example, dysregulated cortisol rhythm is associated with both reduced NK activity and increased mortality in metastatic breast cancer patients.

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Bower, and Steve Cole

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See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
AUTOIMMUNE DISEASES: PSYCHOSOCIAL ASPECTS;  
CARDIOVASCULAR REACTIVITY; CAREGIVING AND STRESS;  
ENDOGENOUS OPIOIDS, STRESS, AND HEALTH; IMMUNE  
RESPONSES TO STRESS; METABOLIC SYNDROME AND STRESS;  
STRESS: BIOLOGICAL ASPECTS; WOUND HEALING AND  
STRESS

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## PSYCHOPHYSIOLOGY: THEORY AND METHODS

Psychophysiology studies the behavior of the individual in a biological context. It is an attempt to chart the mutual interactions between psychological processes and the workings of the body, giving equal emphasis to both. It is fundamental to psychophysiology that behavior and mental life cannot exist apart from the body. It follows that a full understanding of psychological processes depends on understanding the biological context from which they proceed. Because of its emphasis on integrating our understanding of mental and physiological processes, psychophysiology has contributed to research methods and theory building in behavioral medicine. It does this by helping to disentangle the relationships between psychology and biology in relation to good and poor health. From this perspective, psychophysiology brings a physiological emphasis to the study of behavior and mental processes as they affect good and poor health.

The emphasis of psychophysiology, like that of behavioral medicine itself, is primarily on the whole person. However, it is necessary to measure the functions of specific systems, such as the cardiovascular system, endocrine system, or immune system, in the course of psychophysiological investigations. This calls for a methodology that allows emotional experience to be studied along with physiological functioning in ways that are unobtrusive and minimally invasive. This ensures that the person being studied is behaving in a normal manner, as in everyday life, and is not reacting unduly to the apparatus or laboratory setting. Psychophysiological principles have been used to study responses to stress in the laboratory, responses to stressors in daily life, and individual differences in such responses.

Behavioral medicine is both a science and an approach to clinical practice. Both parts are concerned

with the influence of behavioral factors on health and disease. Behavioral medicine holds that states of health can be influenced by overt behaviors, such as dietary habits, and by covert behaviors, such as emotional states and stress responses. This perspective leads behavioral medicine researchers to ask questions about the ways that emotional states and stress responses can affect health through their influence on physiology.

The goal is to bring to light how our behaviors and our ways of perceiving and reacting to the world may affect our well-being for better or worse. Such research addresses questions in several major areas, including (1) how the body responds during positive and negative emotion states; (2) how a given person may differ from one time to the next in stress reactivity; (3) the ways in which persons differ from one another in their stress responses; and (4) on the positive side, establishing the effects of behavior on good health and longevity. To carry out such research, behavioral medicine draws in part on the theory and methods developed in the field of psychophysiology.

In laboratory studies, persons are often exposed to stressors to determine how they react to such challenges both emotionally and physiologically. The results are thought to indicate how emotionally relevant events and behavioral stressors can affect physiology in daily life and therefore whether they may contribute to disease. For example, a commonly used stressor is public speaking. This calls on the subject to make up a short speech and deliver it without notes. Public speaking is stressful because most persons wish to avoid the embarrassment of doing poorly and want to be seen as competent by observers in the laboratory. In this sense, the social world can be modeled in a small way in the laboratory. During public speaking, this process of social evaluation, along with the resulting fear and anxiety, produces substantial increases in heart rate and blood pressure and stress hormones, including catecholamines and cortisol. The person's mood states are assessed while he or she is at rest before the task begins and again at the end, using paper-and-pencil measures or brief interviews. Similarly, automated blood pressure monitors and other recording devices are used to measure cardiovascular functions at rest, during the preparation and delivery of the speech, and afterward during a recovery period. In this manner, the combined cardiovascular and psychological reactions of the person may be measured. Using public speaking as a stressor therefore

provides information on how a person's physiological reactions are set off by psychological causes.

This research strategy can then be extended to compare different kinds of people in their physiological reactivity to stress. One common example is for the researcher to identify young, healthy individuals who have a family history of high blood pressure and also to find those with no such history. These family history groups can then be compared in the laboratory for differences their stress responses, perhaps using the public speaking stressor or some other method. This allows potential differences in stress reactivity to be assessed in relation to a family history of this prevalent cardiovascular disease. It is then possible to follow such persons for a period of years to establish which persons become hypertensive and which retain a normal blood pressure. Do persons from the family history group have a greater likelihood of becoming hypertensive in middle age? Are persons with greater reactions to stress more likely to become hypertensive, regardless of family history? Such studies therefore allow potential interactions between family history and stress reactivity to be studied. If persons with a family history of hypertension who are also highly reactive to social stress are much more likely to become hypertensive, then we would conclude that the family history created a biologically based risk factor that was enhanced by an elevated level of stress responsivity. In contrast, should risk of hypertension be increased equally by high reactivity in persons with and without a family history of hypertension, we would conclude that family history and reactivity tendencies contribute to hypertension risk in an additive manner.

Although the laboratory provides a well-controlled environment with an extensive range of measurement techniques, ambulatory methods have been used with increasing frequency outside the laboratory to document how challenges in persons' daily lives can affect cardiovascular, endocrine, or immune systems. Such methods measure the person's responses to naturalistic stressors, such as work stress, or challenges in the home, such as family conflict or the stress of caring for a chronically ill spouse. Such studies rely on small, lightweight monitors that can be worn comfortably as persons go about their daily routines. These monitors can make reliable measurements in a wide range of circumstances. Such systems are able to track heart rate, blood pressure, and physical activity. In addition, people usually report on their subjective

state using brief paper diaries or personal digital assistants. As in laboratory studies, this ambulatory method may be used to estimate the interaction of stress responses and disease risk. Persons with and without a family history of hypertension may be compared as they go about their daily lives. As in the laboratory, persons with the largest or most prolonged reactions to stress at home or at work are suspected of having greater risk of future disease, and again they may be followed up for actual occurrence of hypertension in future years.

Although some research focuses on family history, other work seeks to connect psychological dispositions, such as hopelessness, depression, or hostile style, to disease risk. Studies using this strategy may compare highly hostile persons with nonhostile individuals with a specific hostility-provoking interaction, such as harassing comments during work on a difficult task. By measuring physiological reactions to such specific challenges in persons with different psychological characteristics, a clearer picture may be developed of the psychological and physiological interplay that is suspected of contributing to disease.

While much of this research focuses on negative emotion states, stress responses, and risk of disease, there is a growing interest in positive emotional states and in studying persons who tend frequently to experience the positive emotions of joy and happiness. As in the above examples, such persons can be selected for their emotion traits using a combination of self-report techniques and in laboratory tests of brain function. Persons high in typical positive affect can then be compared to those with less positive affective states in their resistance to the effects of stress and in their long-term states of health.

The research examples listed above all depend on testing persons while they are relaxed and resting, as well as when they are under stress or perhaps in a pleasurable mood. For these reasons, it is desirable to use measurement methods that do not cause discomfort or distress. Behavioral medicine research has therefore relied on methods of psychophysiological measurement that are noninvasive or minimally invasive and cause the volunteer no discomfort.

The examples above focused on the cardiovascular system, which can be studied using methods such as the electrocardiogram, blood pressure monitoring, impedance cardiography to measure pumping action of the heart and constriction of the blood vessels, and occasionally, fluid output to assess kidney function.

Stress research often uses additional methods to track responses of the endocrine system, involving collection of urine, blood, or saliva for measurement of stress hormones and other substances associated with stress and pain responses. Still other studies examine the immune system, here using minimally invasive techniques in the collection of blood for later measurement of the numbers of immune system cells and their biological activity. Closely related to these physiological measurements is the need to classify persons as to personality and temperament characteristics to establish relationships between acute stress responses or chronic allostatic responses in the lab or in daily life. These considerations call for use of interviews or paper-and-pencil measures of personality and mood states. Finally, the application of such psychophysiological techniques calls for appropriate selection of tasks and ways to analyze the data.

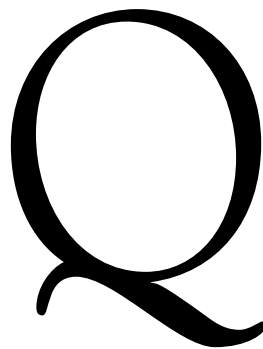
—William R. Lavallo

See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CARDIOVASCULAR PSYCHOPHYSIOLOGY: MEASURES; CARDIOVASCULAR REACTIVITY; EMOTIONS: NEGATIVE EMOTIONS AND HEALTH; EMOTIONS: POSITIVE EMOTIONS AND HEALTH; GENERAL ADAPTATION SYNDROME; HEART DISEASE AND REACTIVITY; HOPELESSNESS AND HEALTH; HOSTILITY AND HEALTH; HOSTILITY: PSYCHOPHYSIOLOGY; IMMUNE RESPONSES TO STRESS; PSYCHONEUROIMMUNOLOGY

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## QUALITY OF LIFE: MEASUREMENT

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There are two very different types of indicator in terms of which the performance of health care may be assessed. The first type, which may be termed the quantity of life, is concerned with the impact of health care on mortality. The second type of indicator is concerned with the quality rather than duration or survival of lives. An evaluation of contemporary health care that only assessed death rates would provide only a very skewed and limited assessment. However, while the measurement of death and survival may be considered a relatively clear and precise task, quality of life is concerned with experiences that are inherently personal and subjective. Nevertheless, confidence has grown in the last 30 years that quality of life can be measured with sufficient accuracy.

Recognition of the importance of quality of life in health care is often traced to the World Health Organization's declaration that health should be considered a state of complete physical, mental, and social well-being rather than merely the absence of disease. Health and illness often have wide-ranging impact on individuals, and the goal of health care is to address these broader impacts. Since the 1970s, an array of instruments in the form of questionnaires and interview schedules, together with models and principles of measurement, have been developed to assess these broader impacts of health and illness. Strictly speaking, in the context of health care, we are concerned with instruments to assess health-related quality of life, rather than quality of life determined by, for example, individuals' education or political environment

outside the realm of health care. However, terminology is not consistent, and instruments are often also referred to as "health status," "subjective health status," and "outcome" measures. An essential feature of such instruments is that, whenever possible, judgments of quality of life are made by the patient or layperson rather than the health professional because of the substantial evidence that patients and health professionals significantly differ from each other in their judgments about quality of life, and it is patients' views that are of ultimate concern.

## USES OF QUALITY OF LIFE MEASURES

Health-related quality of life measures have been developed to fulfill a number of different purposes. First and most important is their use as measures of outcome in the evaluation of health care interventions. Whether the intervention is relatively simple, such as a drug, or is more complex, such as a new type of behavioral intervention or innovative form of clinic, health-related quality of life measures provide unique evidence of the impact of the intervention, in both positive and negative consequences, as viewed by patients. Thus, trials of new drugs intended to have positive effects on survival for patients with cancer, high blood pressure, or neurodegenerative disease will commonly now include measures to assess effects on aspects of quality of life such as mood, symptoms such as pain and nausea, family life, and social functioning. Such trials require that health-related quality of life be assessed before and after the study intervention as well as in control or comparison groups receiving either placebo or best available alternative

treatment in order to specify the impact of the study intervention.

One particular type of quality of life instrument, discussed below, the utility or preference measure, is intended to provide a single global or net measure of the value of a health state to an individual, taking account of all gains and losses in specific areas of quality of life. It has been argued by health economists that these utility measures provide a unique form of outcome measure in evaluations that can be used to produce overall summaries of the net costs and benefits of health care interventions for purposes of planning and prioritizing services.

A second application is the use of health-related quality of life measures to assess the nature and level of health-related problems in a community or group of patients. Particularly as evidence accumulates that quality of life measures are strongly predictive of future health problems and also of future demands upon health care, such measures provide indicators that assist in the planning of services and identification of current or future need. A related but distinct third application is the use of quality of life measures in individual patient care, assessing the patient's needs, and progress in response to treatment. Evaluations of this application suggest that while health professionals find this novel form of information about their patients interesting and helpful, it does not improve the quality of their care and health outcomes.

Finally, quality of life measures can be used to understand problems in health care such as illness behavior and professional-patient relationships. Correlations between conventional laboratory or clinical measures of disease severity and patient-assessed health-related quality of life measures are usually modest rather than high. Health-related quality of life measures often provide better predictors of patients' illness behavior, satisfaction with care, adherence to regimens, and ability to cope with health problems.

## TYPES OF MEASURE

Several different types of health-related quality of life measure have been developed. They have distinct properties and purposes. The first type to be developed was the "generic" measure, so called because they were intended to be applicable in content to the widest range of health problems and patient groups. One of the earliest of such generic instruments to be

widely used was the Sickness Impact Profile (SIP) (Bergner et al., 1976). The SIP comprises 136 statements about the individual for each of which the respondent selects the answer yes or no. Each item contributes to one of 12 scales or dimensions: ambulation, household management, emotions, eating, body care and movement, recreation, alertness, communication, mobility, social interaction, sleep and rest, work. Items are differentially weighted, based on panels' judgments of relative severity. Items can also be summed to produce physical, psychosocial dimension, and overall total scores. A similar instrument, the Nottingham Health Profile (NHP), comprises 38 questionnaire items with binary yes/no responses and six scales: energy, sleep, pain, social isolation, emotional reactions, and physical mobility (Hunt, McEwen, & McKenna, 1986).

By far the most commonly used generic instrument is the Short-Form 36-Item Health Survey (SF-36; Ware & Sherbourne, 1992). Its 36 items contribute to eight scales: physical functioning, social functioning, pain, energy, mental health, health perceptions, role limitations due to physical problems, and role limitations due to emotional problems. Two summary scores, physical and mental component, can be derived from the instrument. An advantage of SF-36 over SIP and NHP is that more than two response categories ("yes" or "no") are provided for each item. Respondents generally prefer questions with possible answers that permit expression of the extent or degree to which a problem is experienced (e.g., "all of the time," "some of the time").

More recently, numerous instruments have been developed intended to provide assessments of specific health problems, hence the term *disease-specific*. Evaluations such as randomized controlled trials to evaluate interventions to improve health-related quality of life increasingly have to detect ever more modest and subtle benefits and side effects. For this reason, it is argued that instruments have to be targeted at the very specific features of particular health problems rather than relying on questionnaire content that is intentionally general. As a result, for most common health problems, there now exist several specifically developed health-related quality of life instruments.

A typical example of a disease-specific instrument is the Western Ontario and McMaster Universities Arthritis Index (WOMAC; Bellamy, Buchanan, Goldsmith, Campbell, & Stitt, 1988). This instrument



comprises 24 items assessing pain, stiffness, and physical function in osteoarthritis of the hip and knee. As an alternative instrument for arthritis, assessing a wide set of consequences of the disease than WOMAC, the Arthritis Impact Measurement Scale (AIMS) comprises 45 items assessing nine dimensions of arthritis impact: mobility, physical activity, activities of daily living, dexterity, household activities, pain, social activities, depression, and anxiety (Meenan, 1982). However, there are several other instruments purporting to assess health-related quality of life in relation to arthritis, differing in range and detail of item content, time-frame addressed by question length and complexity of instrument and extent of available evidence evaluating performance.

Generic and disease-specific instruments have contrasting advantages. Disease-specific measures are intended to provide highly relevant evidence of patients' experiences of a particular disease that may simply be missed by the more general and nonspecific information captured by generic instruments. By contrast, generic instruments may provide evidence of unexpected experiences not normally associated with a specific disease. They also permit comparisons of evidence across diseases and interventions for different diseases that cannot be achieved with disease-specific measures.

Both generic and disease-specific instruments normally have one feature in common, that the content comprises standard questionnaire items. It has been argued that it runs counter to the purpose of quality of life assessment to have invariant content to address issues that inevitably vary between individuals. To meet this criticism, a number of instruments have been developed that contain items that can be individualized by means of the respondent identifying his or her own personal health-related quality of life concerns for assessment. A simple example, also taken from the field of arthritis, is the McMaster-Toronto Arthritis Patient Function Preference Questionnaire (MACTAR; Tugwell et al., 1987). To complete this assessment, patients with arthritis identify their own activities limited by arthritis rather than respond to a standard list of questions; they rank activities chosen in order of preference to have them improved by treatment and subsequently rate extent of improvement in chosen activities. The principle of individualized instruments has been extended from the disease-specific context, and there now exist instruments such as the Schedule for the Evaluation of Individual Quality

of Life that attempt to provide individualized questionnaire content that can be applied across all health care problems (O'Boyle, McGee, Hickey, O'Malley, & Joyce, 1992). Although efforts have been made to turn such instruments into self-completed questionnaires, the added complexity of tasks usually results in such instruments requiring an interviewer.

One final type of instrument is the utility-based or preference-based measure. As already mentioned, it differs from other measures largely in terms of its purpose. The purpose of such instruments is to derive an estimate of the net value to patients or society of health states, usually health states that can be attributed to health care interventions. The values or, in the language of this approach, the utilities associated with an intervention are combined with evidence of the costs of an intervention to provide an overall cost-utility analysis. Decision makers in health care are expected to favor those interventions that have a favorable ratio of costs and utilities.

The utilities associated with given health states are obtained from respondents by one of several experimental techniques employed in interviews. One approach (standard gamble) is to invite respondents to judge what level of risk of death they would be prepared (hypothetically) to face from a treatment that would restore them to normal health. The greater the risk, the lower the level of utility associated with a given health state. Another approach (time trade-off) invites respondents hypothetically to choose between a life spent in a state of ill health that is the object of the study and another life that is healthy but for a shorter duration. Again the assumption is made that the greater the time that respondents forgo, the worse the health state, that is, the lower its utility.

There are some inherent difficulties of comprehension and compliance by respondents in interviews to elicit utilities. For this reason, health-related quality of life instruments in the form of self-completed questionnaires have been developed that have the advantage of standard easy to answer response categories but with utility values assigned to response categories from prior experimental research. The most commonly used of such instruments is the EQ-5D, the core of which requires that respondents, in order to describe their health, choose from three different levels of severity of five simply presented dimensions of health (mobility, self-care, usual activity, pain, mood) (EuroQol Group, 1990). The health state selected has a numerical score determined by previous

lay panels' judgments of the utilities associated with different health states. Attempts have also been made to derive utility values for the SF-36 questionnaire described above. Supporters of this approach argue that, by separating out descriptions of health states from how such states are valued, there is a clearer and more transparent approach to measurement than is usual in quality of life measures.

## REQUIRED PROPERTIES OF MEASURES

For a quality of life measure to work well in the applications outlined earlier, it is essential that it have a number of measurement properties that can only be achieved by careful research in developing the instrument. The four key measurement properties required of an instrument are reliability, validity, responsiveness, and feasibility. These are considered in turn.

*Reliability* is concerned with the reproducibility and internal consistency of a measure. Reproducibility focuses upon whether an instrument produces the same results on repeated applications when respondents have not changed on the subject being assessed. Correlation coefficients provide evidence of the strength of association between repeated tests but are also essential to check for systematic shifts in mean score from an instrument. Retesting of an instrument is normally performed between 2 and 14 days after the first administration on respondents for whom there is other independent evidence that no important change has occurred in relevant aspects of health.

Internal reliability is a distinct requirement because, normally, constructs in health-related quality of life are measured by several questionnaire items that are combined to form a scale. The use of scales reflects a very basic principle of measurement: that several related observations will produce more reliable estimates of the intended construct than one single questionnaire item. However, for this to be true, the extent to which items are addressing a single construct has to be examined by calculating the extent of agreement between items of a scale. As the level of agreement falls between items intended to be a scale, it becomes more likely that the items are not internally consistent measures of a single construct.

The *validity* of a measure is determined by assessment of the extent to which it measures what it purports to measure. A fundamental issue, therefore, is determining the purpose of an instrument. An instrument

validated for use in specific purposes requires further evidence of validity when applied for a new purpose or context. Two approaches to the assessment of validity are essential. First, face and content validity require judgments as to whether an instrument appears to measure its intended target and whether questionnaire items address the full range or scope of the intended construct. It is increasingly accepted that face and content validity are enhanced by the care and extent to which relevant patient groups have participated in the initial development of an instrument.

The second and more formal quantitative assessment of instruments examines construct validity. Here the pattern of associations of an instrument with other data is inspected; for example, a health-related quality of life scale may be expected to have associations with measures of disease severity, health care utilization, and emotional well-being. Crucially, construct validity is not established by one study but by an accumulating pattern of evidence.

*Responsiveness* assesses the extent to which an instrument can detect important changes over time within individuals, an essential feature of any instrument to be used in trials or other forms of evaluation of interventions. As with validity, there are several approaches to assessing responsiveness with no single method dominant. A range of statistical approaches essentially examine the amount of intraindividual change in an instrument in samples expected on other grounds to have experienced change. An alternative set of approaches use external criteria against which to judge change over time in an instrument. For example, patients may be asked (by means of a so-called transition question) to rate the extent to which their health-related quality of life has changed compared to a specific previous occasion. The responsiveness of a health-related quality of life instrument completed at the same time as the transition question and at the specific previous occasion would be judged by level of agreement of change score on the instrument with patients' transition questions.

One of the commonest problems that limits the responsiveness of instruments stems from so-called ceiling and floor effects. Because of the choice and wording of questionnaire items, it may be impossible for respondents to register further improvements or deterioration in health-related quality of life. It is common to consider instruments in which answers are highly skewed to one or the other end of the distribution of possible scores as more prone to such effects.

One last criterion needs to be applied to the evaluation of instruments in this field, *feasibility*. Especially as health-related quality of life instruments are usually completed by respondents when unwell, there is an imperative that they impose as little burden as possible in terms of length, complexity, or distressing content. It is standard practice to ask patients directly about the acceptability of an instrument as part of its development and evaluation. Other indicators of acceptability include the time taken to complete an instrument and its response rate. Feasibility also focuses upon the overall burden to investigators and others in administering and processing an instrument. Some instruments, especially those requiring administration by interview, may require more time to complete and process responses and training on the part of the interviewer. The extent of disruption to normal clinical activity is an important consideration.

There has been increasing interest in reducing the length of instruments to improve overall feasibility. It is quite often possible to produce shorter forms of health-related quality of life instruments with little or no loss of validity and responsiveness.

At present, only a minority of clinical trials use health-related quality of life instruments as measures of outcome, even when it is clear that they would be relevant to the questions addressed by the trial. This partly reflects lack of familiarity with their potential contribution. When they are used, inappropriate measures are often selected. As illustrated earlier with the example of arthritis, there are often several competing instruments from which to choose for any given health problem. More sensible use of appropriate measures of quality of life are more likely to emerge if studies are performed in which two or more instruments are completed at every assessment point over time by all patients. Only with such data can the comparative performance of different instruments against the criteria earlier described be more accurately assessed and understanding of instruments increase. Comparative longitudinal data from trials and similar studies are particularly needed to identify instruments most sensitive to changes in quality of life that matter to patients. In some fields such as cancer and rheumatology, professional consensus groups have also assessed available comparative evidence to determine which instruments are generally most useful. A view emerging from many reviews is that it is optimal practice in trials and evaluative studies to use both a

disease-specific and generic health-related quality of life measure to cover a full spectrum of possible outcomes of interventions.

As applications of health-related quality of life measures increase, it becomes more important to focus on the interpretability of scores from such instruments. Whereas numerical values for familiar clinical measures such as blood pressure and hemoglobin are readily interpreted, this is not the case for measures of quality of life. Different approaches to increase interpretability have been adopted. One approach is to relate particular changes in score on an instrument to more familiar human experiences. Thus, it is possible to estimate the likely change in quality of life score of someone made redundant from work or bereaved; such change scores can then be related to changes in scores observed in clinical trials. Another approach is to calculate scores typical of healthy members of the community, and of patients attending ambulatory or inpatient care, and to use these scores as benchmarks of different levels of life, with poorest scores typically observed in inpatients and most favorable scores observed in healthy members of the community.

Alternatively, more use can be made of transition questions described earlier. Patients who complete health-related quality of life measures at two time points, for example, in a clinical trial before and after an intervention, can also at the second time point make judgments about whether they have noticed a change in dimensions assessed by the instrument. A comparison of health-related quality of life scores of patients noticing that they are a little worse (or better) can be made with the scores of those rating themselves as unchanged in order to estimate average change scores associated with perception of change. Such estimates can be treated as the smallest scores that will be treated as real change rather than noise or random error in an instrument; often referred to as “minimal clinically important change.”

The principle that personal experiences of health and illness can be measured is now well established. Effort is now focused on improving the use and interpretation of measures of health-related quality of life to inform decisions about health care.

—Ray Fitzpatrick

See also CHRONIC ILLNESS: PSYCHOLOGICAL ASPECTS;  
COST-EFFECTIVENESS

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## **RACE AND HEALTH.** *See* **HEALTH DISPARITIES**

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## **RAYNAUD'S DISEASE:** **BEHAVIORAL TREATMENT**

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Raynaud's disease is a disorder of peripheral blood vessels in which blood flow in the fingers and toes stops when they are exposed to cold. The attacks typically last about 5 to 15 minutes, may occur several times a day, and can be quite painful. Because the symptoms are localized, and because healthy individuals can be trained to increase their peripheral blood flow with behavioral methods such as biofeedback, these techniques have been used to treat persons suffering from Raynaud's disease.

The disease was first described by a French physician, Maurice Raynaud, in his doctoral thesis published in 1862. When exposed to cold, the digits first turn white, due to the cessation of blood flow. This is followed by a blue or cyanotic phase caused by depletion of oxygen in the remaining blood. During these periods, the digits feel numb or extremely cold. The attacks often end with a red or reactive hyperemic phase, in which burning and/or pain are experienced due to a sudden inrush of returning blood.

Blood flow in the fingers and toes is controlled by nerves that constrict small blood vessels to reduce blood flow and by chemicals that circulate in the blood. Raynaud thought that the attacks were caused by overactivity of these nerves. However, Thomas Lewis

showed, in a few patients, that the attacks could occur even when these nerves were anesthetized, and our laboratory later verified this in a larger controlled study.

Lewis thought that the attacks were caused by an abnormality in the blood vessels themselves. Several laboratories have shown that the peripheral blood vessels of Raynaud's disease patients were oversensitive to chemicals that circulate in the blood, such as serotonin and norepinephrine, particularly during cooling. However, the amounts of these chemicals in the blood are not abnormally high. The most recent research suggests that the abnormality may lie in the signaling pathways that connect the biochemical receptors for norepinephrine and serotonin with the muscle fibers in the blood vessels that make them constrict.

Raynaud's disease runs in families, suggesting that genetic factors may be involved. However, specific genes that cause Raynaud's disease have not yet been identified. The disease is about four times more common in women than in men and affects about 4% of the population in the United States. Raynaud's symptoms can also occur in conjunction with other diseases, such as scleroderma, where it is referred to as secondary Raynaud's phenomenon. This entry focuses on primary Raynaud's disease.

## **BEHAVIORAL CONTROL** **OF PERIPHERAL BLOOD FLOW**

Biofeedback comprises a set of techniques whereby a physiological function is measured and information immediately presented to the subject, who then learns to control it using mental methods. Finger temperature is generally used as an indicator of blood flow because it can be easily and inexpensively

measured. Feedback can be given using meters, tones, lights, or digital displays.

Edward Taub first showed that normal volunteers could learn to raise and lower their finger temperature, using a variable intensity light as feedback. He also noted that success was dependent, to some extent, on the personality of the trainer. Francis J. Keefe then conducted several controlled studies showing that several combinations of brief temperature biofeedback and suggestions to increase finger temperature produced significant temperature elevations. He also showed that these effects were maintained 1 to 2 weeks after training. Our laboratory then replicated these findings and showed that the training effects were maintained outside the laboratory, in a different environment.

#### BEHAVIORAL TREATMENT OF RAYNAUD'S DISEASE

Behavioral treatments for Raynaud's disease have generally employed finger temperature biofeedback and/or autogenic training, a relaxation-based method using self-suggestions of warm imagery such as, "My hands are warm and heavy." Richard S. Surwit treated 30 patients who were randomly assigned to receive twelve 45-minute laboratory sessions in autogenic training, either alone or in combination with temperature biofeedback. Also, for 1 month, half the patients served as a waiting list control group for the other half and then received treatment. Subjects as a whole showed significant improvement in response to a cold stress test, but there were no significant differences in attack frequency reduction between treated subjects (32%) and waiting list controls (10%). Similar results were found in a subsequent study the following year.

Because the above studies combined biofeedback with autogenic training, our laboratory separated the methods. We compared finger temperature biofeedback, autogenic training, forehead muscle biofeedback (an irrelevant form of feedback used as a placebo control), and temperature feedback given during mild cold stress to the finger. We reasoned that this last procedure would better enable the patients to produce the feedback response in the natural environment, where it must be produced under cold conditions. There were eight patients in each group. The following winter, the patients who received temperature feedback alone, or in combination with cold stress, reported 66.8% and 92.5% fewer attacks respectively. These results were maintained at 2- and 3-year follow-up periods. The patients who received autogenic training or muscle

biofeedback did not report significant symptom reductions. Interestingly, these patients did show signs of relaxation, such as decreased muscle tension and heart rate, whereas the biofeedback patients did not.

These last findings suggested that relaxation was not beneficial in alleviating Raynaud's attacks, and led us to study the mechanisms of temperature biofeedback. Another Raynaud's researcher, Jay D. Coffman, discovered that activation of a class of biochemical receptors in blood vessels ( $\beta$ -adrenergic receptors) could increase finger blood flow without relaxation. We blocked these receptors with a drug ( $\beta$ -blocker) injected into the artery that carries blood to the hand (brachial artery). When we did this during temperature biofeedback, the blood flow elevations stopped. This showed that  $\beta$ -adrenergic receptors are involved. We then anesthetized the nerves to the fingers during temperature feedback, but the temperature elevations still occurred. This showed that the nerve pathways are not needed for temperature biofeedback, just as they are not needed to produce a Raynaud's attack. Finally, we drew blood samples from the hand during temperature biofeedback and analyzed the blood for levels of two main chemicals that cause changes in blood flow: norepinephrine and epinephrine. We found that these levels did not change. Thus, the temperature and blood flow elevations occurring during biofeedback are probably caused by changes in a circulating chemical acting at  $\beta$ -receptors, without the involvement of the finger nerves. This mechanism appears to be independent of physiological relaxation.

Finally, the effects of temperature biofeedback with cold stress and a drug that increases blood flow (nifedipine) were tested in a large multisite, clinical study. Three hundred and thirteen patients were randomly assigned to receive ten 1-hour training sessions in temperature biofeedback or forehead muscle biofeedback (behavioral placebo), or to receive nifedipine or a pill placebo. Standard treatment protocols were followed by all five sites. Nifedipine-treated patients showed a significant reduction in attack frequency (66%) compared to placebo, but the temperature biofeedback patients did not. Examination of the data showed that the temperature biofeedback patients failed to learn to increase their finger temperature. The reasons for this are not known, but may have been due to the use of a standard protocol, without personalized interactions between the therapists and the patients.

—Robert R. Freedman

See also BIOFEEDBACK

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## REPRESSIVE COPING AND HEALTH

The origins of the term *repression* can be traced back to Sigmund Freud, who considered repression as a mechanism of stopping anxiety-reaching consciousness. The modern usage of repression also refers to repression as a way of not attending to negative, emotional information.

However, the use of the term has been considerably developed since the time of Freud. Nowadays, the most popular usage of repression recognizes it as an individual difference variable (or trait), and is thought of as a specific type of coping or defense mechanism that some people exhibit. Consequently, in this conceptualization of repression, individuals are said to have a repressive coping style or exhibit repressive defensiveness. The major defining characteristic of these individuals (who are usually termed *repressors*) is that they do not recognize their own emotional responses and they use a variety of strategies to avoid their negative emotions. They seem to be self-deceivers rather than impression managers, in that they expend a lot of resources in maintaining the belief that they are not prone to negative emotion (self-deception), rather than convincing other people that they are not prone to negative emotion (impression management). Repressors like to see themselves as rational, even-tempered, and calm individuals who are not prone to strong negative emotion.

What are the ramifications of possessing a repressive coping style? Although repressors appear to be psychologically healthy, and there is a lack of evidence that repressors suffer from psychological symptoms, this is not the same for physical health. There is considerable evidence that suggests that the repressive coping style may be associated with adverse physical health.

### DEVELOPMENT OF RESEARCH ON THE REPRESSIVE COPING STYLE

Until the late 1970s, there was a lack of systematic research into repression, partly due to the difficulty in identifying repression for research purposes. One solution to this problem was to treat repression as an individual difference variable or trait and to measure it using questionnaires. One of the most successful early attempts to identify repressors involved using a questionnaire, the Byrne Repression-Sensitization Scale, and individuals who scored low on this scale were called repressors. However, the repression-sensitization scale is really a measure of trait anxiety and does not differentiate between people who are truly low on anxiety and repressors. This led to inconsistent results of laboratory experiments on repression using this measure, as the participants in the "repressor" group would be a mixture of truly low-anxious people and repressors, and the composition would vary with each sample in each experiment. Because of inconsistent findings, research into repression declined.

### THE SEMINAL STUDY

Interest in repressive coping was rekindled by Dan Weinberger and colleagues in 1979 at Harvard University. Weinberger redefined repression based on the pattern of scores obtained from self-report questionnaires of defensiveness as well as trait anxiety. Weinberger added a measure of defensiveness because it had previously been shown to be a measure of repression, independent of anxiety. Individuals with a repressive coping style were defined as people who scored low on a measure of trait anxiety, but to differentiate them from truly low-anxious individuals who also scored high on a measure of defensiveness. In Weinberger and his coworkers' experiment, male students were asked to complete a task that included phrases with sexual content (e.g., "the prostitute slept with the student") or aggressive content (e.g., "his roommate kicked him in the stomach"). Physiological recordings were taken of heart rate, skin resistance, and forehead muscle tension. Repressors compared to nonrepressors (including truly low-anxious individuals) reported the lowest level of subjective distress, although physiological measures indicated that repressors were more stressed than nonrepressors. This pattern of response is a well-replicated finding. When repressors are put in potentially stressful situations, they report low levels of distress but high physiological

arousal. This has been demonstrated in both males and females and in student, general population, and patient samples. Repressors are a substantial group, accounting for 10% to 20% of the population.

#### REPRESSORS AND AVOIDANCE OF NEGATIVE EMOTIONS

How do repressors manage to experience such low levels of negative emotion? There is considerable evidence from various studies that repressors use an avoidant style of processing negative information. For example, in a variety of laboratory tasks where participants are asked to attend to positive or negative information, repressors tend to avoid negative socially threatening information. Similarly, in laboratory tasks where individuals are asked to forget or remember negative words that can be related to themselves, repressors are better than nonrepressors at forgetting negative (but not positive) information.

Avoiding processing negative emotional material may result in poor recall of unpleasant memories, and a number of studies have demonstrated links between repressive coping and the accessibility of negative memories, as repressors also recall fewer negative (but not positive) autobiographical memories from both childhood and adulthood than nonrepressors.

#### REPRESSORS AND CHILDHOOD MEMORIES

It is important to establish that repressors do have something unpleasant to repress, as it is possible that repressors' poor recall of negative childhood memories may just mean they had a happy childhood, with no unpleasant memories to suppress. To explore this, an interview study was conducted by Lynn Myers and Chris Brewin investigating female repressors' childhood experiences. To address the issue of repressors avoiding negative emotion, repressors did not rate the emotionality of their experiences; this was undertaken by independent raters. This bypassed the possibility of repressors interpreting their experiences in a positive fashion. So, for example, in the interview there are a number of specific questions such as, "Did you feel you could go to your parents if you were upset or unhappy?" Independently of whether participants answer yes or no to this question, specific examples of occasions when they could/could not go to their

parents are elicited and form the basis of the interviewer ratings. The results were that repressors' accounts of their childhood were more likely to be characterized by paternal antipathy, indifference, and lack of closeness than nonrepressors. The results of this study provide evidence that repressors do indeed have unpleasant memories to suppress.

#### DO REPRESSORS HAVE SIGNIFICANTLY WORSE HEALTH OUTCOMES?

It has been thought that not attending to bodily signs of distress, such as anxiety, can be detrimental to health. In fact, it has been suggested that attending to bodily signs is necessary for good health. Consistent with this thinking, there is a body of research linking repressive coping to poor physical health.

#### Cancer

There are a number of studies that suggest a link between repressive coping and cancer. Studies have found a higher incidence of repressors than nonrepressors among cancer sufferers in a variety of different age groups: children, adolescents, and adults. Also, in studies of breast cancer, where women have been followed up over time, repressors were more likely to display more rapid progression of the disease than nonrepressors. This link with cancer may be associated with problems of the immune system, as it has been demonstrated in adult and elderly samples that repressors have poor immune functioning.

However, these results should be interpreted with caution, since the majority of these studies have been cross-sectional—in other words they have taken place *after* patients have had a diagnosis of cancer. So, we do not know if these patients had a repressive coping style before or after diagnosis. If they developed a repressive coping style after diagnosis, this would be considered to be a reaction to having cancer and would not be seen as a risk factor for developing cancer. In longitudinal studies (those following a group of cancer patients over time), there are also limitations in that behavioral reasons why repressors may have a poorer outcome have not been investigated in the studies mentioned in this section. For example, repressors may not comply/adhere to treatment or follow recommended health behaviors, but we do not know that, as these behaviors have not been measured.



## Heart Disease

There is evidence to suggest that at least male repressors may be at increased risk of cardiovascular disease through a number of different mechanisms: increased lipid levels, high physiological reactivity to stress, and reacting badly to potentially useful but upsetting information about heart disease.

Male repressors, but not female repressors, have been found to have raised blood lipid levels. In addition, studies suggest that repressors may be at risk due to high physiological arousal in stressful conditions. Certainly, one of the defining characteristics of the repressive coping style in both sexes is their high physiological reactivity to stress. It has also been shown that repressors have higher blood pressure levels than nonrepressors in response to psychological but not physical stressors.

Studies of predominantly male patients with heart disease examined the effect of repressive coping in terms of the efficacy of a cardiovascular education program. The main findings were that repressors tended not to acknowledge the type of lifestyle changes necessary for a successful recovery. Those repressors who did acknowledge these necessary changes were more likely to suffer from more complications (e.g., hospitalization for chest pain, heart attack). Therefore, repressors who did learn about risk factors related to their disease made a poor recovery.

Why is it harmful to teach repressors about cardiac risks? It may be that if repressors gain cardiac risk information, they are more highly aroused by this knowledge than nonrepressors. If this is the case, it may be important to deal with lifestyle changes in repressors via psychotherapeutic interventions.

## Pain

Repressive coping has been linked to impaired pain perception. Typically, repressors require almost twice the amount of electrical stimulation than nonrepressors to elicit judgments of pain and discomfort. This may be seen in terms of repressors' failure to pay attention to distress. Similarly, chronic pain patients who exhibit a repressive coping style self-report low levels of psychological distress associated with pain, but they report higher levels of pain severity and perceived disability. They also tend to fare less well in pain programs.

## Asthma

It has been shown that there is a higher incidence of repressors in asthma patients than would be expected. Repressors account for between 30% to 50% of asthma patients, whereas in the general population this figure is 10% to 20%. Studies have shown that although repressors reported high levels of adherence to their asthma medication, an objective measure of lung function was worse than nonrepressors. Again, this may be seen as a function of repressors self-reporting low levels of distress while experiencing bodily symptoms, in this case, poor lung functioning. However, similar issues apply to those mentioned in the section on cancer above. These results must be interpreted with some caution, as studies are cross-sectional, so that we do not know if these patients were repressors before or after diagnosis. If they developed this coping style after diagnosis, this would be considered to be a reaction to having asthma and would not be seen as a risk factor.

## High Arousal

As well as high physiological arousal already mentioned, repressors appear not to pay attention to distress during minor surgical procedures, such as dental surgery and colonoscopy.

—Lynn B. Myers

See also EXPRESSIVE WRITING AND HEALTH

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## RESEARCH TO PRACTICE IN HEALTH AND BEHAVIOR

Most health professionals would agree that practical decisions about how to treat individual patients should be based on the best available scientific evidence. The 1990s, however, brought a growing realization that scientific knowledge was exerting too little influence on usual clinical practice. A 1990 Institute of Medicine report concluded that less than 5% of medical treatment decisions were based on strong research evidence, about half were based on shared practitioner beliefs that had minimal scientific support, and half were based on personal opinion. Recognition of the dramatic gap between research and medical practice generated an impetus to develop “evidence-based medicine” that could help clinicians to choose treatments, insurers to manage risk, and regulators to set policy based on the “conscientious, explicit use of current best evidence” (Sackett et al., 1996). Implementation was challenging, requiring the assemblage of large, accessible electronic research databases and expert review groups to systematically compile, update, and evaluate the research evidence. The Cochrane Collaborative Group pioneered and continues to undertake expert reviews of evidence for the efficacy of different treatments catalogued by disease. Increasingly, the federal government invests resources to commission reviews of clinical research, create practice guidelines, specify standards of care and quality assurance procedures, and train health practitioners to use them.

The evidence-based movement that began in medicine is now being embraced by other disciplines (psychology, nursing, public health) that practice interventions to promote health. To improve the evaluation of evidence from clinical trials, many major medical journals (e.g., *Journal of the American Medical Association*, *British Journal of Medicine*, *Lancet*) and review groups have adopted the Consolidated Standards of Reporting Trials (CONSORT guidelines) (Moher et al., 2001). CONSORT specifies the full range of information that needs to be provided when reporting clinical trials. Behavioral medicine journals like *Health Psychology* and *Annals of Behavioral Medicine* are now beginning to adopt CONSORT criteria. The Clinical Psychology Division of the American Psychological Association has set out

guidelines for considering a psychotherapy empirically supported, and maintains a list of treatments that qualify. Finally, a subcommittee of the Society of Behavioral Medicine has been mandated to develop guidelines that help clinicians make scientifically informed decisions about behavioral interventions to promote health.

### HOW CLINICIANS MAKE TREATMENT DECISIONS

The evidence-based movement has made great strides toward systematizing scientific knowledge about which treatments improve health most cost effectively. Often, however, the best scientifically supported treatments are not the ones most widely practiced. The gap that now needs to be bridged, therefore, is the one that prevents current research knowledge from being applied as usual clinical practice. To understand what barriers impede translation from research to practice, it is helpful to consider how clinicians make treatment decisions.

When deciding how to treat a particular patient, practitioners respond to several classes of information: evidence, constraints, and patient/clinician factors (Mulrow & Cook, 1998). “Evidence” designates clinical and laboratory data describing the particular patient, as well as generalized research findings characterizing many patients affected by the same problem (i.e., basic research findings concerning the causes and distribution of the disorder, randomized clinical trials of treatments for the condition, and systematized reviews consolidating the findings regarding efficacious treatments).

“Constraints” are contextual, systems-level influences that limit or direct a clinician’s decisional options. These include limitations on practitioners’ time as well as on the range of treatments that third party payers will reimburse. Other constraints involve explicit policies or laws that designate specific treatments as best practice or as minimal standard of care. Explicit policy constraints often have an implicit parallel in shared professional beliefs about what constitutes optimal treatment and in public demand (often driven by media advertising) for treatments perceived as desirable. “Patient factors” that rightfully influence the choice of treatment include an individual’s prior history of treatment successes and failures, as well as personal and cultural beliefs about which treatments are acceptable. For example, even though physician

practice guidelines designate antidepressant medication as the first line treatment for depression, many patients refuse drug treatment or prefer treatment via psychotherapy; others begin and discontinue medications because of side effects; some proportion fail to adhere consistently; and another subset is unable to initiate medication because of concurrent medications or comorbid conditions, including pregnancy. Finally, an influential “clinician factor” is whether the practitioner has training, experience, and comfort in delivering an evidence-based treatment.

### BRIDGING THE GAP BETWEEN RESEARCH AND PRACTICE

Science has increasingly penetrated the clinical decision-making process, and yet further progress remains needed. The evidence base is now accessible for clinicians to consult electronically for help in making treatment decisions. Simplest to use are synthesized, secondary reviews of treatment efficacy, like those provided by the Cochrane Collaborative (2003), National Guidelines Clearinghouse (2003), and Agency for Healthcare Research and Quality (AHRQ; 2003) practice guideline databases. Because these resources were developed for physicians, they often emphasize pharmacological over behavioral treatments. Psychosocial treatments are sometimes covered extensively (e.g., smoking cessation), but more often referenced as minimalist behavioral counseling that can be incorporated into a visit to a general medical practitioner. At the opposite extreme are fully manualized, multisession behavioral treatments delivered by trained therapists. These have generally been studied by psychologists, and their evidence base can be accessed by more laboriously searching psychINFO or Medline using the search filters “randomized controlled trial,” “double-blind,” “clinical trial,” and “meta-analyses.” Treatment manuals, usually unpublished, can often be obtained by contacting the researchers.

Efforts are under way to address system constraints that insulate practice from research knowledge. Examples include Robert Wood Johnson initiatives to heighten managed care’s coverage of tobacco control interventions, tying insurance reimbursement to the extent of a treatment’s basis in research support. Technological advances are easing the burdens that treatment places on practitioner and patient time. Increasingly, computerized “expert” systems are

becoming available to perform assessments and tailor-make interventions accordingly. Telephone and Internet delivery channels are being implemented to make treatment accessible outside the logistical constraints of geography, scheduling, traffic, childcare demands, and time of day.

Still badly in need of systematization into the evidence base are client and practitioner factors that should meaningfully influence treatment. Research is only now beginning to characterize demographic and cultural disparities that moderate treatment outcome. Yet, on a daily basis, practitioners and clients actively negotiate treatment choices that balance real-world constraints, personal idiosyncrasies, and scientific knowledge. Only rarely does a client’s condition match a clear prototype, with a well-founded treatment acceptable to both practitioner and patient. Often, no treatment has an adequate evidence base, or the presenting problem is ill defined or co-occurs with comorbidities whose relative urgencies are hard to prioritize. One treatment, a pharmacotherapy, may empirically be superior to alternatives, but it may have failed previously or provoked an allergy for the particular patient or be culturally unacceptable to him or her. There may be a validated manualized behavioral treatment for the condition, but not one that the clinician has practiced. Trying to follow an unfamiliar manual may detract from forming the kind of therapeutic alliance that is empirically validated to help clients initiate healthful behavior change. Such are the messy realities that practitioners confront daily and that frighten researchers striving for scientific clarity. Eventually, such complexities need to be addressed. Doing so will make the clinical research base more relevant to practitioners, who will in turn be empowered greatly by having their decisions more securely grounded in science.

—Bonnie Spring and  
Sherry Pagoto

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## RHEUMATOID ARTHRITIS: PSYCHOSOCIAL ASPECTS

Rheumatoid arthritis (RA) is an autoimmune disease characterized by joint inflammation. The cause of RA is unknown, and there is no known cure. Although RA can attack any joint, the wrists and knuckles are almost always involved, with the knees and feet often affected as well. Over time, RA inflammatory processes can gradually digest cartilage and bone in affected joints. Other physical symptoms commonly associated with RA include pain, fatigue, muscle aches, and low-grade fever. RA also can damage other body systems, including the lungs, eyes, nervous system, and cardiovascular system. Although RA sometimes manifests and resolves within a few months, most individuals with RA experience a more

chronic disease pattern, characterized by waxing and waning of severe symptoms, with progressive disfigurement and disability. RA is about two to three times more common in women than men, and the prevalence is greater in older people. There also appear to be ethnic/racial variations. For example, the estimated prevalence in Caucasian populations is 1% to 2%, whereas approximately two to three times as many Native Americans have RA.

### BIOPSYCHOSOCIAL FACTORS AND RA

Biopsychosocial approaches in medicine focus on the interplay between physical factors (e.g., swollen painful joints in RA) and associated psychosocial factors such as an individual's mental health and levels of social support. RA is best viewed from a biopsychosocial perspective because it is expressed and experienced within a web of overlapping psychosocial factors.

### PAIN

Many individuals with RA experience significant pain. Interestingly, most research suggests that RA-related pain is more closely associated with psychosocial factors than with disease-related variables. For example, high levels of emotional distress, poor coping, and low levels of social support have been more closely associated with increased pain than have measures of disease activity like number of swollen joints. However, relationships between pain and psychosocial variables can be complex. For example, emotional difficulties like depression may increase sensitivity to pain, but experiencing chronic RA pain also may increase the likelihood that individuals will become depressed. Also, whereas anxiety usually increases pain if an individual is at rest, high levels of anxiety in stressful distracting situations often decrease perceived pain levels.

Although psychosocial variables significantly influence RA-related pain, physiological factors also play an important role. For example, individuals with chronic pain sometimes notice that perceived pain may "spread" beyond parts of the body clearly affected by disease activity. In fact, research suggests that intense persistent pain signals can change the message patterns between affected parts of the body and the spinal cord/brain, thereby expanding the range of stimuli that cause pain sensations. Also, because

pain signals appear to be hardwired into parts of the brain associated with negative emotions like anger and anxiety, individuals experiencing chronic pain may be more inclined to experience these negative emotions, independent of psychosocial factors.

## FATIGUE

Fatigue also is a troublesome problem for many individuals with RA. Rates of fatigue have been found to be 80% and higher among individuals with RA, and even though fatigue is not a diagnostic criterion for RA, over 50% of individuals with RA have reported that fatigue is the most problematic aspect of their disease. As with pain, a growing body of research suggests that fatigue may be relatively independent from standard measures of disease activity, and is more strongly associated with psychosocial variables like higher levels of pain and depression and lower levels of social support.

## NEGATIVE AFFECT

Not surprisingly, many individuals with RA experience a range of negative affect (i.e., emotions like depression and anxiety). Estimated rates of clinically significant depression and anxiety among individuals with RA range between about 15% to 45%. Some data indicate that middle-aged and younger individuals are more prone to depression and anxiety than older individuals with RA. In any case, mood disturbance is strongly associated with increased pain, increased functional impairment, and overutilization of medical services. Also, although measures of disease activity are associated with psychological distress, other variables like pain severity, neuroticism, daily stressors, work demands, and functional ability appear to be better predictors of anxiety and depression.

## STRESS

The multifaceted concept of “stress” is important to a biopsychosocial understanding of RA. One meaning of the term *stress* refers to situational factors that act as stressful stimuli. As discussed above, RA often produces pain and psychological distress, which are, in themselves, significant stressors. Having RA also can create a number of other stressors, including reductions in home and work-related activities, and, correspondingly, financial hardship secondary to

decreased earnings and increased health care costs. Finally, approximately half of individuals with RA report problems in the areas of social interaction and communication with others. Perhaps not surprisingly, higher perceived levels of positive social support tend to buffer the adverse effects of environmental stressors, whereas lower levels of social support have been associated with increased physical disability and depression.

Although stressors have not been reliably associated with the onset of RA, minor stressors and daily hassles have been associated with exacerbation of symptoms in already established RA. Somewhat paradoxically, some evidence suggests that major life stressors like the death of a family member can be associated with decreases in disease activity. The effects of diverse types of stressors on RA disease activity may be a consequence of differential activation of stress-related physiological systems.

Although a variety of physiological systems are involved in stress responses, two are particularly relevant to the current discussion: (1) the hypothalamo-pituitary-adrenal (HPA) axis, which produces cortisol, a hormone that generally down-regulates immune functioning, and (2) the sympathetic adrenal-medullary (SAM) system, which produces adrenaline and noradrenaline and generally activates immune functioning. Several lines of evidence suggest that in RA, the HPA axis is hypoactive, whereas the SAM system may be hyperactive. This could explain why acute stressors tend to exacerbate RA disease symptoms, in that they increase immune functioning, thereby intensifying the autoimmune action of RA. In contrast, chronic stress situations may prompt a strong enough release of cortisol to down-regulate immune functioning and, somewhat paradoxically, improve RA disease symptoms.

## COGNITIVE AND COPING FACTORS

The relationship between RA and two cognitive factors, learned helplessness and self-efficacy, has been well studied. Helplessness refers to a state where individuals believe they lack viable ways to eliminate or alleviate sources of stress. Because RA symptoms can wax and wane unpredictably, patients with RA may be particularly susceptible to helplessness. In any case, individuals with RA reporting high levels of helplessness are more likely to report higher pain levels, greater depression, and greater functional

impairment. Self-efficacy tends to be more behavior specific, and refers to the confidence individuals have regarding their own ability to perform specific goal-directed tasks. For example, individuals with low self-efficacy are less likely to persist and comply with treatment regimens, regardless of their beliefs about the potential helpfulness of the intervention. In RA, increases in self-efficacy have been associated with decreased depression, pain, and disease activity, and increased treatment adherence.

Coping refers to behaviors aimed at managing internal or external demands with available resources. Important distinctions include the difference between problem-focused versus emotion-focused coping, as well as passive versus active coping. Generally, emotion-focused and passive coping approaches have been found most maladaptive for individuals with RA. For example, passive strategies characterized by catastrophizing (e.g., making a mountain out of a mole hill) or hoping that things will just get better have been associated with greater pain and psychological distress, and poorer functional outcome.

## WORK DISABILITY

Rheumatic disease is the leading cause of work loss and the second leading cause of work disability payments, and roughly 25% to 50% of individuals with RA are disabled after one decade of the disease. A number of risk factors for RA-related work disability have been identified, including poor disease status, increasing time off work, less education, less social support, and depression.

## BIOPSYCHOSOCIAL CONSIDERATIONS AND RA TREATMENT

The foregoing section highlights the interconnected biopsychosocial aspects of RA. For example, one can readily conceive of a situation where RA produces painful joints, which limits function, which fosters depression, which in turn promotes work disability, which exacerbates marital problems, which further increases disease activity. Fortunately, these biopsychosocial interconnections also point to effective treatment approaches.

Pharmacological management of RA is usually geared toward control of underlying disease processes with disease-modifying antirheumatic drugs such as hydroxychloroquine and methotrexate, as well as

pain management with medications like nonsteroidal anti-inflammatory drugs (e.g., ibuprofen and naproxen). Many individuals with RA respond adequately to such treatment. However, these interventions are not sufficient for many other patients. Thus, effective management of RA often requires appropriate and individualized attention to psychosocial variables. Increasing evidence suggests that multimodal approaches (i.e., those that combine medical, cognitive-behavioral interventions, and exercise under the auspices of appropriate professionals) are the most effective treatments for individuals with RA who do not respond adequately to conservative biomedical interventions.

Comprehensive and action-oriented interventions like cognitive-behavioral therapies (CBTs) have been associated with a variety of positive outcomes, including decreased pain, depression, and anxiety, and increased self-efficacy, function, and work levels. These treatment gains tend to be long term (i.e., over 12 months) for many individuals, particularly among those who continue to practice coping skills on a regular basis. Key components of this approach include three basic elements: (1) education/rationale for treatment (e.g., explaining pain theories and the interrelationships between psychosocial factors and RA), (2) coping skills training (e.g., relaxation training, explanation of effective pacing strategies, and cognitive restructuring), and (3) relapse prevention (e.g., emphasizing the importance of continued practice of new behavioral skills and learning to identify early signs of relapse like increased pain or depression).

Most CBTs for RA are delivered in classroom-type settings at hospitals or medicine clinics. However, newer delivery systems such as telephone counseling and mail-delivered self-management programs also have been associated with a variety of positive outcomes, including improved psychological functioning, increased functioning, and improvements on disease parameters. Also, emotional disclosure of stressful events via journaling has been associated with improved psychological functioning and disease status parameters in individuals with RA. As suggested above, multimodal management of RA frequently includes exercise interventions. Many individuals with RA have low levels of physical fitness, and this contributes to a variety of problems, including excess fatigue, low functional status, low pain threshold, sleep disturbances, and depression. Fortunately, increased physical fitness in young and

old individuals with RA often improves range of motion, muscle strength, general conditioning, and functional abilities, and reduces pain, fatigue, and depression, without exacerbating disease severity.

—Bruce A. Huyser and  
Jerry C. Parker

See also CHRONIC DISEASE MANAGEMENT; CHRONIC PAIN  
MANAGEMENT

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## SCHOOL-BASED HEALTH PROMOTION

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School-based health promotion refers to activities that occur in schools and on school grounds that facilitate student and school staff adoption of healthful behaviors and healthful lifestyle choices. School-based health promotion is not just about teaching students what they should do to be healthy; rather, it includes providing environments where making the healthy choice is the easy and normative choice for students. School health promotion includes not just health education but also provision of healthy foods offered throughout the school, daily physical education that is fun and includes all students, a tobacco- and drug-free campus, a social environment where healthy choices are modeled and reinforced by students and adults in the school, and policies that create psychological, social, and physical environments that support health and wellness in students and school staff.

School-based health promotion is very important as the health behaviors of youth affect their health as youth as well as their risk for future chronic diseases. Next to families, schools are the most important community institution for enhancing and protecting youth health. Not only do the vast majority of youth attend school, but schools also provide the social, normative, and physical environments wherein youth health behaviors are learned, practiced, modeled, and solidified.

School health promotion is an important part of comprehensive or coordinated school health. Comprehensive school health is a model where health

and nutrition services, health education, and healthy school environments, including health promotion for students and staff, occur with the support and involvement of parents and the larger community as an integrated system. While the realization of fully comprehensive school health is yet elusive, there is evidence that multicomponent programs using elements of comprehensive school health and health promotion can make significant changes in student health behaviors.

## EVOLUTION OF SCHOOL-BASED HEALTH PROMOTION PROGRAMS

The modern school health era began in 1850 with the publication of the Shattuck report drawing attention to the role that schools play in communicable disease. For the first time ever, schools were recognized as convenient public institutions in which to provide health care, specifically vaccinations, to youth as well as being potential sites for the spread of infectious diseases. At the beginning of the 20th century, school nurses were involved in reducing the spread of disease in schools, treating minor ailments at school, communicating with parents, conducting medical inspections of students, and making referrals to physicians.

School health began to inch toward health promotion after World War I. Beyond preventing communicable disease, schools were recognized as good places to educate youth on the importance of healthy behaviors, including brushing teeth, eating a healthy diet, playing outdoors daily, sleeping with the windows open, and bathing at least once a week! Nutritional deficiencies seen in draft inductees in World War II



led to the institutionalization of the federally sponsored National School Lunch Act, designed to use surplus agricultural commodities and funds to provide nutritious lunches for schoolchildren. School health was slowly moving from an emphasis on taking care of sick children in schools to an emphasis on preventing disease and promoting wellness by encouraging and promoting healthy behaviors (Allensworth, Lawson, Nicholson, & Wyche, 1997).

In the 21st century, much is new, but much is the same in school health. Certainly, communicable diseases are still a concern in schools and school nurses still provide some of the same services as they did at the beginning of the 20th century. New health concerns of youth are helping to shape school-based health promotion, however, and expanding its scope from detecting and treating acute illnesses to preventing illness and promoting health. Results from the 1997 Youth Risk Behavior Survey (YRBS) of students in Grades 9 through 12 (a survey administered nationally by the Centers for Disease Control and Prevention) spotlight some of the health issues that schools address in health promotion activities (Bogden, 2000). According to the survey, less than 30% of students had eaten the recommended five or more servings of fruits or vegetables during the day before the survey and nearly half of the females surveyed and a quarter of the males surveyed had not participated in vigorous physical activity for at least 20 minutes on at least 3 days of the week before the survey.

These behavioral trends in tandem with the dramatic rise in youth obesity in the past 30 years have brought attention to the role that schools play in feeding children and providing them with opportunities to be physically active (Troiano & Flegal, 1998). The 1997 YRBS data also revealed that more than one third of high school students were current smokers, one half of all students had at least one drink in the past 30 days, and one third had five or more drinks in one sitting. Sixteen percent of the students had sniffed glue or inhaled aerosol sprays to become intoxicated. Student use of tobacco, alcohol, and other drugs has resulted in the call for health education to help students learn the dangers of those substances and the social skills needed to resist social pressure to initiate use.

The YRBS also showed that nearly half of all high school students had sexual intercourse at least once in their lifetime and 16% had four or more sex partners. More than one quarter of male high school students

had carried a weapon (e.g., a knife, gun, or club) in the past 30 days and nearly half had been in a physical fight in the past 12 months (Bogden, 2000). School health has expanded to address these health issues as well. Some schools now offer parenting classes and varying options of sex education; conflict resolution classes have been adopted as school curricula in some states.

Health behaviors of youth may have both immediate and delayed consequences; sexual activity, drug use, and violent behaviors obviously have potential negative sequelae in the short term. While not as alarming, the existence of other proximal consequences of unhealthy behaviors are supported by data that suggest that students who engage in healthier behaviors such as eating breakfast and being physically active have lower absenteeism rates at school and come to school better prepared to learn (Bogden, 2000).

Other health behaviors, such as smoking, dietary behaviors, and physical activity, were previously considered as risk behaviors for youth only to the extent that the less healthful behavior was maintained into adulthood. The vast majority of adult smokers begin smoking before they are 18 years old, putting them at risk for cardiovascular disease and cancer. Students who learn to prefer diets high in fat, sodium, and calories and low in fruits, vegetables, and fiber when they are young, and do not change their diet as they mature, put themselves at risk for cardiovascular disease, diet-related cancers, and other chronic diseases (Committee on Diet and Health, 1989). Students who are not physically active as youth may find it hard to begin to be active as adults, perpetuating a cycle of inactivity borne from the difficulty in starting to be active when one is not physically fit.

While the implications of chronic disease risk for adult morbidity are still very relevant, the nation is facing an epidemic of childhood obesity with rates more than doubling in the past 30 years (Troiano & Flegal, 1998). For the first time ever, non-insulin-dependent (Type 2) diabetes in youth is emerging. Some studies have reported a 10-fold increase in the incidence of Type 2 diabetes in children (Dabelea, Pettitt, Jones, & Arsianian, 1999). While the causes of childhood obesity and non-insulin-dependent diabetes are very complex, most experts agree that diet and activity levels play a very important role. It is estimated that tobacco, diet, physical activity, drugs and alcohol, sex, and intentional and unintentional injuries

account for 70% of adolescent morbidity and mortality (Allensworth et al., 1997), making health promotion efforts in youth a national priority.

The U.S. Department of Health and Human Services (DHHS) determines and publishes health directives or goals for the nation on a regular basis. These goals address the priority areas for reducing the nation's morbidity and mortality costs. The most recent of these directives is Healthy People 2010 (DHHS, 2000). The Healthy People 2010 goals include goals both at the individual and the institutional levels. For example, included in Healthy People 2010 are the following nutrition-related goals targeting change at the individual level: (1) Reduce the proportion of children and adolescents who are overweight or obese, and (2) increase the proportion of persons age 2 years and older who consume at least two daily servings of fruit. Goals are also written targeting changes at the institutional or school level. For example, goals for the delivery of school physical education classes include the following: (1) Increase the proportion of adolescents who participate in daily school physical education, and (2) increase the proportion of adolescents who spend at least 50% of school physical education class time being physically active (DHHS, 2000). Goals found in Healthy People 2010 reflect the recognition that health promotion involves more than positive behaviors of individuals, it also involves creating more healthful institutions and communities.

In the new millennium, schools serve as an important venue for improving the health and the health behaviors of youth. Schooling is the only universal entitlement for youth in the United States. Not only do most of America's children attend school, making school the most convenient and efficient place to disseminate information and skills for positive health behaviors, it is also the only organized institution that engages the four major systems of influences—family, friends or peers, school, and community (Allensworth et al., 1997). The inclusion of these four systems of influence in a single community institution provides the capacity to affect change not only through the traditional means of health education, teaching students health-related knowledge and skills for making healthy choices, but also through positively influencing normative beliefs and expectations of family, other adults in the lives of youth and peers, and establishing policies and creating school environments that reinforce and facilitate healthy choices.

Schools have the opportunity not only to educate by what is taught in the classroom but also to create environments where healthy choices are modeled by peers and school staff, where healthy behaviors can be reinforced, and where the school environment facilitates, encourages, and models healthy choices. In other words, schools are an important place to both talk the talk and walk the walk for positive youth health behaviors.

#### ELEMENTS OF SCHOOL-BASED HEALTH PROMOTION

School-based health promotion has most commonly been considered as part of a comprehensive school health program. The vision of comprehensive school health programs has been evolving over the past century. For the majority of the 20th century, three components made up a school health program: (1) health instruction, focusing on a health education curriculum; (2) health service, focusing on prevention, identification, and remediation of student health problems; and (3) a healthful environment, focusing on the physical and psychological setting.

The Centers for Disease Control and Prevention (CDC), Division of Adolescent and School Health, has been a leader in developing a vision of comprehensive school health and in providing schools and communities with tools to help create healthier schools. In the 1980s, the CDC introduced its vision of comprehensive school health, which includes eight components: (1) health education; (2) physical education; (3) health services; (4) nutrition services; (5) health promotion for staff; (6) counseling, psychological, and social services; (7) healthy school environment; and (8) parent and community involvement. Advocates of the eight-component comprehensive school health model discuss the need to integrate these components and to involve interdisciplinary teams of school, family, student, and community stakeholders to accomplish goals (Allensworth et al., 1997; Marx, Wooley, & Northrop, 1998).

The CDC has also attempted to further the mission of creating healthier schools and healthier children through publishing and disseminating CDC guidelines, or position papers. To date, four guidelines have been released, one for preventing the spread of AIDS, and the others dealing with tobacco, school nutrition, and physical activity (CDC, 1988, 1994, 1996, 1997). The guidelines present the rationale for health promotion

in the content area and present recommendations for curricular, policy, environmental, and family school involvement. The recommendations in the four reports are intended to help policymakers at the school, state, and national levels meet national health objectives and education goals through school-based health promotion programs tailored to meet local needs.

The vision of comprehensive or coordinated school health programs has generated much discussion in the school health community; however, realization of such programs has been quite elusive. In the mid-1990s, an Institute of Medicine expert panel was convened to study comprehensive school health programs in Grades K-12. It defined comprehensive school health promotion as

an integrated set of planned, sequential, school-affiliated strategies, activities, and services designed to promote the optimal physical, emotional, social, and educational development of students. The program involves and is supportive of families and is determined by the local community based on community needs, resources, standards, and requirements. It is coordinated by a multidisciplinary team and accountable to the community for program quality and effectiveness. (Allensworth et al., 1997, p. 60)

The emphasis of this definition is on community and family involvement, multiple interventions, integration of activities, and collaboration across disciplines.

In fact, truly comprehensive and integrated school health programs are rare. Even the best programs include only some of the components and evidence of integration of components is sparse. Challenges to implementing quality school health promotion programs as noted by the Institute of Medicine report include (1) difficulty in the dissemination of recommendations and guidelines from the national to the local level; (2) lack of involvement of critical community stakeholders for the design, implementation, and support of school health promotion efforts; (3) lack of interdisciplinary collaboration and communication; and (4) inability of schools to deliver medical services commonly dispensed through the private sector.

The largest challenge for comprehensive school health or strong school-based health promotion programs may be the lack of stable and adequate funding for schools. When financial resources are inadequate, schools have limited options to remedy the situation. Some of those options include cutting back on health

promotion programming and health services; another option involves subsidizing income through sales of food not included in the federally supported reimbursable meals or entering into pouring rights contracts with soft drink companies. These contracts usually involve payments to schools in exchange for the school's agreement to exclusively offer the company's products in vending machines and at school events. Approximately 200 school districts in 33 states had "pouring rights" contracts with soft drink companies by early 2000. A Colorado school district entered into an \$8 million, 10-year agreement with Coke that included cash bonuses to the district for exceeding sales targets (Nestle, 2002). Obviously, such agreements add challenges to creating a healthful school food environment.

If the connection between health and learning is not understood or appreciated by the nation, state, school district, principal, parents, or taxpayers, funding for school health services and school health promotion will suffer. Recognition of the links between health and student success and well-being as well as involvement and commitment of stakeholders in the community will be essential for the realization of vital and effective school health programs (Marx et al., 1998).

#### CHILD AND ADOLESCENT TRIAL FOR CARDIOVASCULAR HEALTH (CATCH): AN EXAMPLE OF A SCHOOL-BASED HEALTH PROMOTION PROGRAM

The Child and Adolescent Trial for Cardiovascular Health (CATCH) was a school-based health promotion research trial conducted in the 1990s to assess the effectiveness of a multicomponent health promotion program in reducing cardiovascular risk factors in elementary-age children. Ninety-six schools and more than 5,000 students in four states were involved in the research conducted in elementary schools with children in third to fifth grades (Luepker et al., 1996). The CATCH intervention targeted five channels for health promotive change: health curriculum in Grades 3 to 5, families of third to fifth graders, physical education (PE) classes, the school cafeteria, and school policies for tobacco-free schools (Perry et al., 1997).

The CATCH health curriculum used behaviorally based lessons designed to encourage students to eat foods lower in total fat, saturated fat, and sodium; to be more physically active; and to resist the initiation

of tobacco use. The lessons included simple snack preparation, provided skill-building practice by asking students to generate solutions to challenges for being active, and practice social skills to resist peer pressure to try tobacco. All lessons were designed to be interactive, experiential, and fun and were taught by classroom teachers trained to deliver the CATCH lessons.

Half of the schools receiving the CATCH intervention also had a family component. Families received take-home packets with homework and activities that supported and reinforced the behavioral messages in the CATCH classroom curriculum. In addition, in Grades 3 and 4, families attended a Family Fun Night at the school where students performed an aerobic dance routine, healthy snacks were served, and carnival-type booths and games reinforced the heart-healthy messages.

CATCH PE worked with school PE specialists to modify classes so that students would spend more time in moderate to vigorous activity during class and less time being inactive. The emphasis was on including all students in all activities, reducing competition as an emphasis, and enhancing student enjoyment of being active. In schools where PE was offered for less than 90 minutes per week, classroom teachers were trained to deliver CATCH PE as part of their classroom activities.

CATCH Eat Smart involved training and working with school food service personnel to reduce the total fat, saturated fat, and sodium that were offered in school meals by modifying recipes, food purchasing patterns, and food preparation. CATCH also worked to help schools and school districts implement policies for tobacco-free schools. The CATCH curriculum and family components focused on affecting individual or family motivation, skills, sense of competence, and perceptions of the barriers and benefits of heart-healthy behaviors. CATCH PE, Eat Smart, and policy approaches for tobacco-free schools focused on changing the school environment to increase students' exposure to healthy food, activity, and smoke-free options and to provide positive role modeling and normative support for heart-healthy choices (Perry et al., 1997).

The effectiveness of the CATCH intervention was determined by comparing change in 40 schools randomized into the control condition with 56 schools randomized into the intervention or treatment condition between baseline and the end of the intervention.

The student-level indicators included some physiological assessments such as serum cholesterol, blood pressure, and body composition as well as behavioral assessments including dietary intake, physical activity levels, and tobacco use behaviors. In addition, the health-related knowledge and attitudes were assessed in the students participating in the study. The effectiveness of the school- or environmental-level aspects of the intervention were evaluated by assessing activity levels during PE class and the school lunch menus and recipes for total fat, saturated fat, and sodium content before and after the CATCH intervention, comparing intervention and control schools.

At the end of the 3-year intervention period, there were no statistically significant changes in the physiological measures taken. However, students who were enrolled in CATCH schools showed statistically significant decreases in their intake of dietary fat and saturated fat as compared to students in the control schools and reported participating in significantly more vigorous physical activity during the day. Likewise, students in the CATCH intervention schools had statistically significantly more positive scores on scales measuring knowledge and health behavior attitudes (Luepker et al., 1996).

Positive results were also seen at the school or environmental level. CATCH intervention schools increased the amount of time that students were involved in moderate to vigorous and vigorous physical activity during PE class as compared to nonintervention CATCH schools. Schools participating in Eat Smart significantly reduced the amount of energy, total fat, and saturated fat offered to students in school lunch. Before the CATCH intervention, the average fat content of school meals as offered had 39% of the energy from the meals coming from total fat. At the end of the intervention period, CATCH intervention schools had reduced that amount to 32% of energy from total fat, nearly reaching the nationally recommended amount, which is 30% of energy from total fat.

Health behaviors learned, practiced, and modeled while students were in Grades 3 to 5 were maintained as demonstrated in a follow-up CATCH study. Students' dietary, activity, and smoking behaviors were assessed after they left their CATCH schools and moved into middle school. Even in the absence of the CATCH intervention program, eighth grade students who had participated in CATCH intervention activities during their elementary years still ate significantly less total fat and saturated fat and reported higher

levels of physical activity as compared to students who attended CATCH control schools (Nader et al., 1999).

CATCH used elements of a coordinated school health promotion program to affect students' eating, physical activity, and tobacco use behaviors. It involved five of the eight components of comprehensive school health, with the exception of health services, health promotion for school staff, and counseling, psychological, and social services. CATCH showed that students can adopt and maintain healthier eating and activity behaviors when learning occurs in a school environment that supports healthy behavioral choices. CATCH also showed that schools can change the way that they operate when their awareness is raised and they receive training and support for making healthful changes.

—Leslie Lytle

See also HEALTH PROMOTION AND DISEASE PREVENTION

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### SELF-EFFICACY

The recent years have witnessed a change in the health field from a disease model to a health model. It is just as meaningful to speak of levels of vitality and healthfulness as of degrees of impairment and debility. Viewed from this perspective, health is measured not only in terms of life span and mortality and disability rates but in years of healthy life. The quality of health is heavily influenced by lifestyle habits. By

exercising control over several health habits, people can live longer and healthier, and slow the process of aging. The structuring of health promotion should begin with goals, not means. If health is the goal, psychosocial approaches provide an important means to it.

This entry analyzes the application of social cognitive theory to health promotion and disease prevention (Bandura, 1997). This theory identifies a core set of determinants, specifies the mechanism through which they produce their effects, and provides guides on the optimal ways of implementing them. The core determinants include knowledge of health risks and benefits of different health practices, perceived self-efficacy that one can exercise control over one's health habits, outcome expectations in the form of expected costs and benefits for different health habits, the health goals people set for themselves and the concrete plans and strategies for realizing them, and perceived facilitators and the social and structural impediments to the changes they seek.

Knowledge of health risks and benefits is one contributing factor. If people lack knowledge of how their lifestyle habits affect their health, they have little reason to put themselves through the agony of changing the injurious habits they enjoy. Knowledge of health risks and benefits creates the precondition for change. But additional self-influences are needed for most people to overcome the impediments to adopting new lifestyle habits and maintaining them.

Beliefs of personal efficacy play a central role in social cognitive theory. Perceived efficacy refers to people's beliefs in their capabilities to exercise control over their own functioning and over events that affect their lives. Efficacy belief is the foundation of human motivation and action. Unless people believe they can produce desired effects by their actions they have little incentive to act or to persevere in the face of difficulties. Whatever else may serve as guides and motivators, they are rooted in the core belief that one has the power to produce desired changes by one's actions.

Health behavior is also affected by the outcomes people expect their actions to produce. Outcome expectations can take three major forms. One set of outcomes includes the physical pleasures and the aversive physical effects the behavior produces. Behavior is also partly regulated by the social reactions it evokes. The social approval and disapproval the behavior produces are the second major class

of outcomes. People adopt personal standards and regulate their behavior by their self-reactions. They do things that give them self-satisfaction and self-worth, and refrain from behaving in ways that breed self-dissatisfaction. This third class of outcomes concerns the positive and negative self-evaluative reactions to one's health behavior.

Personal goals, rooted in a value system, provide further self-incentives and guides for health habits. Goals may be long-term ones that set the course of personal change or short-term ones that regulate effort and guide action in the here and now.

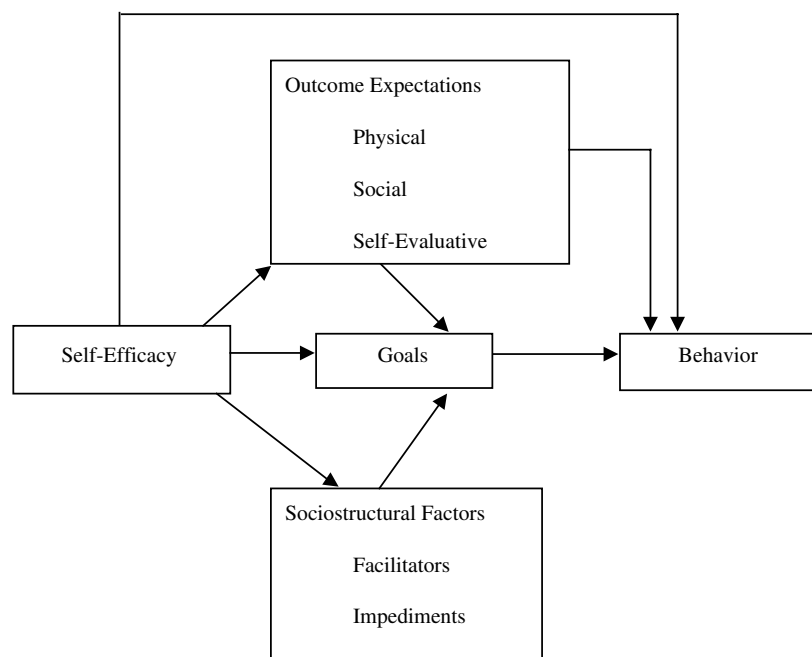
Personal change would be easy if there were no impediments or barriers to surmount. The facilitators and obstacles people see to changing their behavior are other determinants of health habits. Some of the impediments are personal ones that deter performance of healthful behavior. Others are social obstacles and still others are rooted in how human services are structured socially and economically.

## CAUSAL STRUCTURE

Self-efficacy is a key determinant because it affects health behavior both directly and by its influence on these other determinants. Efficacy beliefs determine goals and aspirations. The stronger the efficacy, the higher the goal challenges people set for themselves and the firmer their commitment to them. Efficacy beliefs shape the outcomes people expect their efforts to produce. Those who are assured in their efficacy expect favorable outcomes. Those who expect deficient performances of themselves expect their efforts to bring poor results. Efficacy beliefs also determine how obstacles and impediments are viewed. People of low efficacy are easily convinced of the futility of effort in the face of difficulties. Those of high efficacy view impediments as surmountable through perseverant effort and improvement of self-management skills. Figure 1 presents the paths of influence in the causal model. Perceived self-efficacy affects health behavior both directly and by its impact on goals, outcome expectations, and perceived facilitators and impediments.

## SELF-MANAGEMENT MODEL FOR HEALTH PROMOTION

Habit change is not achieved through an act of will. It requires development of self-regulatory skills.



**Figure 1** Paths of Influence Through Which Key Social Cognitive Factors Regulate Motivation and Health Behavior

Self-regulation operates through a set of psychological subfunctions that must be developed and mobilized for self-directed change (Bandura, 1986). Neither good intentions nor desire alone has much effect if people lack skills for exercising influence over their own motivation and behavior.

People cannot alter their health if they do not monitor their health status and health habits. Therefore, success in self-regulation partly depends on keeping close track of one's health-related behavior. Self-monitoring is the first step in efforts to improve one's health but, in itself, such information provides little basis for self-directed influence.

People motivate themselves and guide their behavior by the goals, aspirations, and challenges they set for themselves. Goals motivate by enlisting self-commitment to the activity. The effectiveness of goals depends on how far into the future they are projected. Long-range goals specify the destination, but they are too distant to serve as current motivators. There are too many competing influences for distant futures to regulate current behavior. People need to set short-term goals to get themselves to stick to the undertaking. Subgoal attainments build self-efficacy and strengthen motivation. People also need to learn how

to create incentives for themselves and to enlist social supports to sustain their efforts.

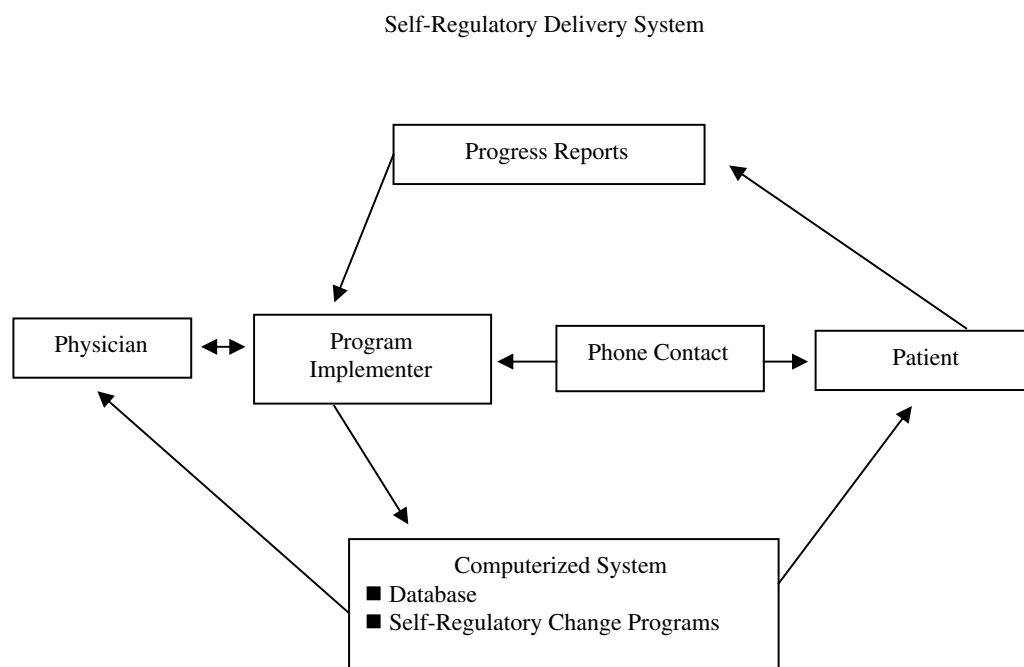
DeBusk and his colleagues have devised a self-management system combining self-regulatory principles with computerized implementation that promotes habits conducive to health and reduces those that impair it (Bandura, 1997; DeBusk et al., 1994). The system is founded on knowledge of the major subfunctions of self-regulation and their self-efficacy underpinning.

A few health habits have a major impact on the quality of health. To stay healthy, people must exercise, reduce dietary fat, refrain from smoking, keep blood pressure down, and develop effective ways of managing stressors. For each health habit, individuals are provided with detailed guides on how to achieve and maintain behavior conducive to health. A single program implementer, assisted by the computerized system, can oversee the behavioral

changes of hundreds of participants concurrently. Figure 2 portrays the structure of the self-management system. Participants monitor the behavior they seek to change. They set short-range, attainable subgoals to motivate and guide their efforts. They receive detailed feedback of progress as further motivators for self-directed change.

At selected intervals, the computer generates and mails to participants individually tailored guides for self-directed change. These guides provide attainable subgoals for progressive change. The participants send performance cards to the implementer on the changes they have achieved and their perceived efficacy for the next cycle of self-directed change. Efficacy ratings identify areas of difficulty that foretell likely relapse unless participants are taught how to manage them effectively. The computer-generated feedback portrays graphically the progress patients are making toward each of their subgoals and shows their month-to-month changes, and also suggests strategies on how to surmount the identified difficulties.

In preventive applications of this self-management system, people lower risk factors for disease by altering their health habits under the guidance of a single implementer. The self-management system is also



**Figure 2** Computer-Assisted System for Self-Management of Health Habits

successful in promoting lifestyle changes in individuals who are beginning to suffer medical problems. Coronary artery disease, which poses high risk of heart attacks, is but one example (Haskell et al., 1994). In long-term follow-up, those receiving medical care by their physicians showed no change or a slight worsening of their condition. In contrast, those aided in self-management of health habits achieved large reductions in risk factors. They lowered their intake of saturated fat, lost weight, lowered their bad cholesterol and raised their good cholesterol, exercised more, and increased their cardiovascular capacity. This system can also alter the physical progression of disease. Those receiving the self-management program had 47% less buildup of plaque on artery walls. They also had fewer coronary events, fewer hospitalizations for coronary heart problems, and fewer deaths.

The effectiveness of the self-management system has also been compared with the standard medical postcoronary care to reduce morbidity and mortality in patients who have already suffered a heart attack. The self-regulatory system has been shown to be more effective in reducing risk factors and increasing cardiovascular functioning than the standard medical care.

The social utility of the self-management system can be enhanced by a stepwise implementation model.

sufficient structured guidance to accomplish the changes they seek.

Individuals who harbor self-doubts about their efficacy make half-hearted efforts to change their health habits and are quick to give up when they run into difficulties. They need additional support and guidance by interactive means to see them through tough times. Much of the guidance can be provided through tailored print or telephone consultation. Individuals who believe that their health habits are beyond their control need a great deal of personal guidance in a stepwise mastery program. Graduated successes build belief in their ability to exercise control over health habits and bolster their staying power in the face of difficulties and setbacks.

The self-management system to health promotion combines the high individualization of the clinical approach with the large-scale applicability of the public health approach. The system is well received for several reasons. It is individually tailored to people's needs. It provides them with continuing personalized guidance and informative feedback that enables them to exercise considerable control over their own change. It is a home-based program that does not require any special facilities, equipment, or attendance at group meetings that usually have high drop-out rates. It is not constrained by time and place. It can serve large numbers of people simultaneously and

In this stepwise approach, the level and type of interactive guidance is tailored to people's self-management capabilities and motivational preparedness to achieve desired changes. The self-management system lends itself well to calibrating the amount of interactive guidance needed to attain desired changes. People of higher self-efficacy and positive outcome expectations can succeed with minimal interventions that provide



provide them with valuable health-promoting services at low cost.

In previous applications, the computer is used mainly as a tool to guide self-directed change through enabling instruction, goal setting, and feedback of progress. Linking the interactive aspects of the self-management system to the Internet can vastly expand its reach and availability. Online interactivity can further boost the health promotive power by providing a ready means of strategic guidance and for enlisting social support when needed. The amount and form of personalized guidance can be tailored to recipients' needs. Much needed productivity gains in risk reduction and health promotion can be realized by creatively coupling the knowledge of self-regulation with the disseminative and instructive power of computer-assisted implementation.

## PUBLIC HEALTH CAMPAIGNS

Societal efforts to get people to adopt healthful practices rely heavily on persuasive communications in public health campaigns. These population-based approaches pick off the easier cases in the stepwise model. For the most part, these are people with a high sense of self-management efficacy and expectations that personal changes will improve their health. Meyerowitz and Chaiken (1987) examined four alternative mechanisms through which health communications could alter health habits: transmission of factual information about the determinants of health and disease, fear arousal over the prospect of disease, change in risk perception, and enhancement of perceived self-efficacy. They found that health communications fostered adoption of preventive health practices primarily by their effects on perceived self-efficacy. These findings indicate that efforts to enhance the effectiveness of public health campaigns to promote health require a shift in emphasis from trying to scare people into health to empowering them with the tools and self-beliefs of efficacy to exercise control over their health habits.

Analyses of how community-wide media campaigns change health habits similarly reveal that both the preexisting and developed levels of perceived self-efficacy play an influential role in the adoption and social diffusion of health practices (Maibach, Flora, & Nass, 1991; Rimal, 2000). The stronger the preexisting perceived self-efficacy, and the more the media campaigns enhanced people's self-regulative efficacy,

the more they adopted the recommended practices. It is the individuals with a high sense of efficacy who translate health knowledge into healthful practices. Many people change detrimental health habits on their own. For example, more than 40 million people have quit the smoking habit on their own, even though nicotine is one of the most addictive drugs. Longitudinal studies show that heavy smokers who quit on their own had a stronger sense of efficacy at the outset than did continuous smokers and relapsers (Carey & Carey, 1993).

The absence of performance trials with enabling and supportive feedback places limits on the power of one-way health communications. The revolutionary advances in electronic technology provide the means to enhance the reach and productivity of health promotion programs. On the input side, health communications can now be personally tailored to relevant attributes, such as sociodemographic status, efficacy beliefs, outcome expectations, and perceived facilitators and impediments. Personalized communications are viewed as more relevant and credible, are better remembered, and are more effective in influencing health behavior than general health messages. The benefits of individualization will, of course, depend on the predictive value of the tailored factors. Development of good measures for key social cognitive determinants of health will provide informative guides for tailoring strategies.

Individualized interactivity, on the behavioral adaptation side, further enhances the impact of health promotion programs. Interactive computer-assisted feedback provides the means for informing, motivating, and guiding people in their efforts to make lifestyle changes. The enabling personalized feedback can be adjusted to participants' efficacy level, the unique impediments in their lives, and the progress they are making.

There is another way in which the power of population-based approaches to health promotion can be substantially augmented. There is only so much that large-scale health campaigns can do on their own, regardless of whether they are tailored or generic. As previously noted, there are two pathways through which health communication can alter health habits, the direct pathway and the socially mediated pathway, which links participants to informal social networks and community settings that provide ongoing guidance and support for desired changes.

The social linking function of media presentations is illustrated in worldwide applications of serial

television dramas to stem the soaring population growth and the environmental devastation it produces (Bandura, 2002). The story lines model family planning, women's equality, beneficial health practices, and a variety of effective life skills. Epilogues connect viewers to enabling and supportive social systems. These dramatic serials raise people's efficacy to exercise control over their family lives, enhance the status of women, and bring families to family planning clinics where they receive extensive guidance. Dramatic segments that center on modeling safer sexual practices eliminate cultural misbeliefs about HIV transmission, increase adoption of condom use, and reduce the number of sexual partners.

Psychosocial programs for health promotion will be increasingly implemented via interactive Internet-based systems. Individuals at risk for health problems typically shun preventive or remedial health services. But they will pursue online assistance because it is readily accessible and convenient, and it provides a feeling of anonymity. For example, young women at risk of eating disorders reduce dissatisfaction with their weight and body shape and alter disordered eating behavior through interactive Internet-delivered behavioral guidance (Taylor, Winzelberg, & Celio, 2001). In the electronically mediated pathways, the impact of population-based approaches is augmented by linking people to interactive online systems that provide ongoing individualized guidance for personal change. Such systems can also promote supportive connectedness to others mastering similar problems.

## SOCIALLY ORIENTED APPROACHES TO HEALTH

The quality of health of a nation is a social matter, not just a personal one. Health promotion, therefore, requires changing the practices of social systems that affect health rather than just changing the habits of individuals. The central focus is on enablement of people to work together to influence social, political, and environmental practices to promote public policies conducive to health. Such social efforts are aimed at raising public awareness of health hazards, educating and influencing policymakers, mobilizing public support for policy initiatives, and devising effective strategies for improving health conditions. People's beliefs in their collective efficacy to accomplish social change play a key role in the policy and public health approaches to health promotion and disease prevention (Bandura, 1997).

While collective efforts are made to change unhealthful social practices, people need to improve their current life circumstances over which they have some control. The approaches that work best promote community self-help through collective enablement. Consider a community effort to reduce infant mortality resulting from unsanitary conditions in poor neighborhoods (McAlister, Puska, Orlandi, Bye, & Zbylot, 1991). The community was fully informed of the impact of unsanitary conditions on children's health through the local media, churches, schools, and neighborhood meetings conducted by influential persons in the community. The residents were taught how to install plumbing systems, sanitary sewerage facilities, and refuse storage. They were shown how to secure the funds needed from different local and government sources. This self-help program, which provided needed resources and enabling guidance, greatly improved sanitation and markedly reduced infant mortality.

To contribute significantly to the betterment of human health by psychosocial means requires broadening the perspective on health promotion and disease prevention beyond the individual level. This calls for a more ambitious socially oriented agenda of research and practice. The impact of psychosocial programs on human health can be further amplified by making creative use of evolving interactive technologies that expand the scope and strength of health promotion efforts.

—Albert Bandura

See also CHRONIC DISEASE MANAGEMENT; ECOLOGICAL  
MODELS: APPLICATION TO PHYSICAL ACTIVITY; ECOSOCIAL  
THEORY; HEALTH PROMOTION AND DISEASE PREVENTION

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## SELF-REPORTED HEALTH

*Self-reported health* can be defined as the individual's personal evaluation of overall health. Many terms are used to describe this measure of health, such as self-reported health, self-rated health, self-assessed health, self-perceived health, self-appraisal of health, subjective health, perceived health status, general health rating, and general health perception.

Self-reported health differs from other health measures because the individual is asked to integrate all

aspects of health without specific reference to the different components of health, such as physical, mental, social, or functional health, and without being prompted in one direction or another. Each individual may integrate different aspects of health depending on cultural, demographic, socioeconomic, and individual factors.

This simple-looking measure composed of one question has been found to be a very powerful measure of health when trying to understand health and social aspects of individuals and societies. When developing the measure it was intended to be used as a proxy for other more objective but more difficult to collect health measures. Soon it was obvious that self-reported health appears to add information to that obtained from objective measures of specific health components. Since its development, it has been used for (1) describing and following the health of populations, (2) screening populations to identify high-risk groups and risk factors, (3) studying variables affecting health, and (4) studying variables affected by health.

The advantage of the measure is in its ability to predict future health outcomes and in its simplicity, the data are easily collected in a questionnaire.

## DEVELOPMENT OF THE MEASURE

The use of self-reported health began mainly in studies of the elderly, but later the use broadened to include middle-aged and younger populations. Lately, this measure has also been used in research of adolescents. Today, in different countries this measure is an intrinsic part of many studies and national surveys.

The use of this measure started in the 1950s when researchers developed a one-item question and a multi-item question to rate general perception of health (Ware, Davies-Avery, & Donald, 1978). The Health Perception Questionnaire (HPQ) was developed during the 1970s with 32 items divided into eight scales, and it was used in the Health Insurance Study. However, most of the research during the past 30 years regarding self-perception of health uses the one-item question. At first there was a need to validate the new measure and see if the measure actually represents the health of the individual. Already in the 1960s and 1970s, self-reported health was found to be strongly associated with and predictive of survival and other health outcomes; this gave a great boost to the use of self-reported health.

During the past 50 years, a lack of consensus has been observed regarding the terms used and the wording of the questions and the categories (answers) regarding the one-item question (self-reported health).

### Wording of the Measure

Differently worded questions have been used to prompt the individual's evaluation of overall health, and these have changed over the years. Moreover, different answering systems to the question have been provided.

Two general concepts of the question exist. The first is a general request for overall evaluation of health, with wordings such as

1. In general (all in all) would you say your health is excellent, very good, good, fair, or poor?
2. How would you characterize your health overall?
3. How is your health in general?
4. How would you rate your health (at the present time) (these days) right now?

The second type is a comparative question, with wordings such as

1. Compared with others your age (and sex) would you say your health is . . .
2. How would you rate your health compared to others your age?
3. Is your health better, worse, about the same as it was 10 years ago?

The methods of scoring the question vary too. Between four and seven categories can be provided with wording such as *excellent*, *very good*, *good*, *fair*, and *poor*, or *very good*, *pretty good*, *not so good*, and *poor*. Comparative categories exist, too, such as *better*, *same*, *worse*. These questions have been translated to many different languages. The most frequently used question is the noncomparative general question.

Not much attention has been given to the differences in wording, and the assumption has been that the influences of linguistic variations in the questions were small. The variations in wording of the question, however, may contribute to the discrepancies between various studies in the literature. Moreover, analysis of

the differences between the two types of questions (comparative and noncomparative) may provide useful information about how people evaluate their health.

Lately, many questionnaires include both types of questions, the general type and the comparative type, enabling the analysis of the differences between the two types of questions. A certain percentage of people tend to give a different answer to the two questions; for example, older people tend to rate their health as better compared to people their age and younger people tend to rate it as worse compared to people their age (Baron-Epel & Kaplan, 2001).

### HOW DO PEOPLE EVALUATE THEIR HEALTH?

Self-reported health represents an overall summary of different aspects of one's health. The process by which respondents construct their judgment is affected by different components of health and is processed in various ways depending on the individual. Culture, values, and beliefs also play a role in the evaluation of subjective health. This complex process of judging one's health consists of a few steps, such as collection of objective and subjective information relevant to the individual's health, deciding on the priority of the different aspects of health, integration and evaluation of the information, comparing this evaluation to the individual's social surroundings, and making a final judgment.

Generally, there seem to be three different issues influencing the evaluation of subjective health, the first is the actual health, objective and subjective; the second is the cultural surroundings in which the individual lives; and the third is the comparisons the individual performs in order to judge subjective health.

More specifically, knowledge, information, and perceptions that the individual has about many factors, such as physical illness or diseases, mental health, general feeling, pain, disabilities, tiredness, medications, medical treatments, social factors, and health behaviors, may play a role in the self-evaluation of health.

Research indicates that factors influencing how individuals respond to the question about their self-rated health can be grouped into three broad categories. The first includes emotional aspects or perceived "feelings" of health, general feeling, and emotional feelings. The second category includes all biomedical issues, such as diseases, medication, and

pain. The third category relates to functional issues, such as inability or difficulty in performing certain activities. The influence of each component may vary in different populations; older people were found to report functional issues as more influential than younger people, and those reporting suboptimal self-reported tiredness and pain as more influential. Younger people seem to relate more to health behaviors they perceive as having an effect on health (Kaplan & Baron-Epel, 2003).

Cultural and environmental surroundings have an influence on the subjective evaluation of health. For example, individuals living in a community with many diseases and no health care system may perceive their health as optimal even though in the same situation in a healthier community this perception would be different. This can be related also to the comparative factor within the measure. People with more education and better medical facilities may have better skills with which to evaluate their health compared to people in less advantaged communities. Culture may influence sensitivity to symptoms, interpretation of their severity and significance, and behaviors adopted to deal with health (prevention and treatment). Moreover, in certain communities beliefs that are part of the culture may influence the verbal expression of ill health. In some cultures, people may express in general worse health and in others they may express better health depending on their perception of the expectations of their society. Therefore, comparing this measure between different cultures with different beliefs and attitudes about health can be very problematic (Wiseman, 1999).

Comparing one's health to others or other times may also play a role even when not asked to compare one's health to other factors.

The individual performs a spontaneous comparison of health to others that can be explained using the sociological reference group theory, which assumes that self-reported health depends on the individual's comparison group. Generally, this comparison exists spontaneously in a high percentage of individuals. Elderly people more often than young people compare their health to their age peers without being prompted to do so. It has been found that patients with Parkinson's disease seem to select others of their own age rather than others with the same disease for this comparison. Older people with poor self-reported health also spontaneously compare themselves more often to people their age compared to people in good health. Each

individual may try to find ways to evaluate health in a more positive way without being prompted in a certain direction.

## DETERMINANTS OF SELF-REPORTED HEALTH

Many longitudinal and cross-sectional studies analyzed the factors determining self-reported health. Cross-sectional surveys indicate associations between self-reported health and other factors, and longitudinal studies may indicate prediction and even causality. All the determinants mentioned were shown to be associated independently or to be independent predictors of self-reported health after adjusting for other factors that are associated with self-reported health. However, there is not always an agreement across studies on the effect of these determinants. In many of the cases, prediction and causality are assumed even though not demonstrated.

The strongest predictors of self-reported poor health are self-reported diseases or disease history, number of diseases, somatic and psychological symptoms, and medication. These medical factors are thought to have a causal effect on self-reported health.

Self-reported health has been found to depend also on demographic and socioeconomic factors, such as age, sex, income, education, social class, and place of residence. Generally, a higher percentage of women and older people report poor health, and a lower percentage of better-educated people report poor health. It has been found that low literacy is strongly associated with poor self-reported health, and the association is stronger than the association with years of schooling. This research was performed in developed countries and therefore it may not be possible to generalize these findings to other populations in less developed countries (see Ross & Van Willigen, 1997). People with lower income and those living in rural areas were also found to report poorer health. Social class predicts the worsening of self-reported health in follow-up studies. Work environment and lifestyle factors can explain a high percentage of this variation. Working conditions and lifestyle may contribute to or cause ill health in the long run; self-reported health is an expression of this ill health. It is important to note that not all these determinants have the same effect on both sexes.

Functional limitations or disabilities are also an important determinant of self-reported health. However, not all types of disability have the same

effect on self-reported health. It seems that in men disability in mobility and basic activities of daily living (ADLs) did have an effect on self-reported health, whereas disability in instrumental activities of daily living (IADLs) had no effect.

Most of the health measures studied in association with self-reported health were negative measures or absence of limitations; however, positive indicators of health may also play a role in determining self-reported health. In women, mobility measured as speed of walking and difficulty in walking was found to be associated with lower self-reported health. Measures such as speed during everyday activities, energy levels or feeling of energy, positive mood, social support, and active functioning had an independent effect on self-reported health.

Self-reported health is affected by depression, poor adjustment to the environment, distress, and mood (negative and positive), all representing mental health. Individuals reporting high levels of distress, for example, more frequently report lower levels of self-reported health.

Personal traits, such as locus of control and perceived control, may also have an effect on the evaluation of health.

Individuals with better social networks, social support, and family relationships have a higher chance of reporting positive self-reported health. The quality and quantity of social support (e.g., intimacy, reciprocity, number of social contacts) all are associated with self-reported health.

Lately, the research interest in the association between individuals' social surroundings and their self-reported health seems to be rising. For example, regional income inequality, measured by the Gini index, was found to be associated with worse self-reported health, especially among those with the lowest income. This may also depend on the type of area the individual lives in, mainly urban compared to rural areas. In non-metropolitan areas and rural areas, the association between self-reported health and inequality seems to be much stronger. These social factors remain after allowing for variation in individual-level factors.

In a follow-up study, poverty area residence was a strong predictor of decline in self-reported health. In another study, neighborhood environment, measured by the Care Need Index (CNI), was found to be associated with self-reported health: Respondents living in deprived neighborhoods reported poorer health after

adjusting for other variables. Social capital, defined as the extent of interpersonal trust, norms of reciprocity, and density of civic associations (terms that facilitate cooperation for mutual benefit), was found to be associated with self-reported health; low social capital is associated with poor health. All in all, the characteristics of the community in which the individual lives seem to be associated with self-reported health (Kawachi, Kennedy, & Glass, 1999).

Specific social groups may show a different pattern of associations with self-reported health. For example, immigration status was also associated with low self-reported health; however, the concept of self-reported health may depend on the level of acculturation.

Nearly all the research was performed with middle-aged and elderly people, moreover, the same factors determine lower levels of self-reported health in adolescents, health problems, disability, age, being a woman, lower income, smoking, and higher BMI (body mass index).

The amount of variance in self-reported health that can be explained by a long list of health status correlates rarely exceeds 40%. This demonstrates the independence of the self-reported health measure and the fact that we do not yet fully understand all the factors contributing to the subjective evaluation of health.

## THE PREDICTIVE VALUE OF SELF-REPORTED HEALTH

Research interests in self-reported health have grown considerably since follow-up studies found that self-reported health predicts a number of future health outcomes. The most important outcome is survival or mortality, and much research in the past 25 years has been directed that way (Idler & Benyamini, 1997). Self-reported health can predict mortality or survival in longitudinal studies. The first study reporting this ability to predict mortality was published in 1963, and thereafter many studies showed that the survival chances for those reporting optimal self-reported health were higher than those reporting poor health. Populations have been followed up for different periods of time from 2 years up to more than 20 years, depending on the age of the population.

Extremely consistent findings emerge from these studies. Most of the research on the prediction of survival or mortality has been performed in the older populations. The prediction of survival by self-reported health persists also for populations of middle-aged

people, younger populations, and people with specific diseases or risk factors such as smoking. The prediction of survival was tested also in many communities around the world with the same findings implicating the generalization of the prediction. However, there are specific groups of people in which this prediction may not be valid. For example, in immigrants, the prediction of mortality may depend on the level of acculturation; thus, in those not yet acculturated, self-reported health is not a good predictor of survival. Instead it may express the stress of acculturation and not the overall health that predicts mortality.

Self-reported health and survival were studied together with measures that are known to be associated with survival, such as demographic variables, data from medical records, self-reported chronic diseases, measures of functioning, medication use, health care utilization, height, weight, blood pressure, other physical measures, cognitive function, health behaviors, and social networks or support. In most of the studies, self-reported health holds an independent effect when all covariates are entered into the statistical model. After adjusting for these variables and others, using statistical regression models, the self-reported health measure added to the understanding of the variation in survival. The adjusted odds ratio reported in most studies ranges from about 1.5 to about 3 for the survival of those reporting better health compared to those reporting poor health. Therefore, self-reported health adds information beyond the known mortality risk factors.

Univariate association between survival and self-reported health are observed both in men and women. However, the prediction of survival seems to be different in men compared to women after adjustment for other variables, although these differences are not consistent. All studies show a strong prediction of mortality in men for those reporting poor health after adjusting for other variables. However, in women, in most studies, when adjusting for other variables, the association between self-reported health and survival or mortality diminishes. In women, some studies show that socioeconomic factors, physical health status, and disability can explain the relationship between self-reported health and survival. This may imply a difference in the way women evaluate their health compared to men. It has been suggested that in older people women's evaluation of health incorporates factors not related directly to mortality, such as negative affect, emotional distress, and disruptive but

non-life-threatening diseases (such as musculoskeletal problems), together with factors related to mortality, whereas in men the major factors taken into account when evaluating health are life-threatening issues. Older women may incorporate into their health evaluation the distress from events in other lives surrounding them as they are more involved in the lives of those around them, and these do not have an impact on the individual's mortality.

Self-reported health has been found to predict other health-related variables less dramatic than mortality. In follow-up studies, poor self-reported health predicted functional limitations, disability, receiving disability pension, future morbidity, hip fracture, recovery from illness, future physician rating of health, and institutionalization in the elderly. Self-reported health was also a predictor of long-term use of health services including visiting a general practitioner and community nurse, home help support, hospitalization, and increased medication use.

In follow-up studies, poor self-reported health predicted high levels of distress (low mental health) and together with the fact that distress adds to low self-reported health, these findings point to a downward spiral reaction. Distress may cause poor self-reported health, which leads over time to more poor self-reported health. Self-reported health can serve as a useful tool for identifying individuals at risk for subsequent health problems that may be preventable.

Four possible interpretations have been proposed for the relationship between self-reported health and adverse health outcomes (Idler & Benyamini, 1997). The first suggests that self-reported health is a holistic overall estimation of health that incorporates all aspects of health—physical, mental, social, and more—and that this is not possible when measuring specific aspects of health. Only the individual can make this overall summation of health. This may even include symptoms of undiagnosed diseases, judgment of severity of current diseases, and family history. The second interpretation can be called the “trajectory” interpretation in which the individual not only reports current level of health status but also anticipates future decline in health. The third explanation suggests that perceptions of one's health affect health behaviors, therefore affecting health in the long run. People with poor self-reported health will not adopt preventive behavior, screening practices, or self-care and will not adhere to medication and treatment, therefore enhancing morbidity and mortality. The fourth explanation

suggests that the individual, when evaluating health, incorporates the availability of external and internal resources that can help in preventing the decline in health. To date, there is no preferred interpretation to explain the relationship between self-reported health and health outcomes.

#### FUTURE USE AND RESEARCH OF SELF-REPORTED HEALTH

The findings presented provide support for using self-reported health as a proxy or holistic measure of health in other studies where health is a nondependent variable that can explain other phenomena. Self-reported health can be regarded as a measure representing more than the medical aspects of health, and as such it can be a powerful overall measure to use in research. Self-reported health serves as a proxy for health in studies that look at factors that may be affected by health but in which health is not the main interest. As such, self-reported health serves to control for health in statistical models. For example, it was found that tiredness in daily activities at age 70 was an independent predictor of mortality after controlling or adjusting for self-reported health.

Moreover, self-reported health enables us to understand additional factors affecting health. These data support the idea that medical diagnosis cannot cover all aspects of health, and there may be subjective aspects that affect health in the long run. Uncovering these additional personal aspects should not be overlooked when trying to understand the overall picture of health.

To date, most researchers are tempted to conceptualize self-reported health as a causal factor in health outcome measures such as survival. However, there is no concrete evidence to consider self-reported health as a causal factor in health outcomes. This concept of causality could bring on interventions to try to change self-reported health where there is no evidence that this would bring positive results. The difference between causality and prediction should be explored further in the future.

—Orna Baron-Epel

See also SOCIAL CAPITAL AND HEALTH; SOCIOECONOMIC  
STATUS AND HEALTH

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## SEXUALLY TRANSMITTED DISEASES: PREVENTION

The American public health system has been reluctant to address sexual health issues openly because of the stigma associated with sexually transmitted diseases (STDs). This is embedded in wider cultural taboos about sexual health issues, such as sex education and teen pregnancy prevention. Annually, there are 12 million new cases of STDs, of which 3 million are in adolescents. In fact, among the top 10 diseases subject to mandatory reporting by U.S. authorities in 1995, 5 of them were STDs.

#### EPIDEMIOLOGY AND TYPES OF STDs

The relative estimated incidence of common STDs in 1994 is chlamydia, 4 million; gonorrhea, 800,000; syphilis, 101,000; genital herpes, 200,000 to 500,000; and trichomoniasis, 3 million. However, Americans underestimate their risk for acquiring an STD. In a 1993 survey, 84% of women surveyed were not



concerned about acquiring an STD, including 72% of women between 18 and 24 years of age, even though 78% of those women reported having multiple partners over their lifetime (EDK Associates, 1994). The results of another study of individuals selected because they are at high risk for acquiring an STD provides further corroboration that Americans are not realistic about their perception of risk for STDs: 77% of the women and 72% of the men stated that they were not worried about getting an STD (EDK Associates, 1995).

There are 25 infectious organisms divided into three types that are transmitted through sexual activity: (1) bacteria (e.g., *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Treponema pallidum* [syphilis]); (2) viruses (e.g., HIV, Types 1 and 2 [AIDS]; herpes simplex virus, hepatitis B virus); and (3) protozoan (e.g., *Trichomonas vaginalis*).

The STD health consequences range from mild acute illness to serious problems associated with reproductive health (e.g., infertility, ectopic pregnancy, stillborns, chronic pelvic pain), liver disease, cancer, neurological damage, and even death. Women are more vulnerable to serious consequences from STDs because they are often asymptomatic, which delays the diagnosis and treatment of curable STDs.

## MODEL OF INFECTIOUSNESS

To understand the role of behavior change in preventing the further spread of STDs, it is helpful to examine the May and Anderson (1987) model of the reproductive rate of an STD:

$$Ro = BcD.$$

The reproductive rate of transmission ( $Ro$ ) is assessed by the measures of infectivity or transmissibility ( $B$ ), interaction rates between susceptibles and infectors ( $c$ ), and duration of infectiousness ( $D$ ). All of the factors on the right hand side of this formula can be influenced by individual behavior change. The degree of infectivity can be decreased by increasing condom use or by delaying the initiation of sexual activity. The infection rate can be influenced by decreasing the number of new partners or being monogamous. Duration of infections can be affected by seeking early treatment for STD treatment (Fishbein, 1997).

## THEORIES OF BEHAVIOR CHANGE

To address the behavior change required to address the factors in the model of infectiousness, it is important to understand why people put themselves at risk for STDs and any other adverse health outcomes and what motivates them to reduce their risky behavior. Three theories predict individual behavior change and have had a profound impact on the development of STD prevention programs: (1) the health belief model (Rosenstock, Strecher, & Becker, 1994), (2) the social cognitive theory (Bandura, 1994), and (3) the theory of reasoned action (Fishbein, Middlestadt, & Hitchcock, 1991).

Five theorists convened by the National Institute of Mental Health for a workshop reviewed the common variables in these and other behavior change theories. There was consensus that there are eight common variables central to predicting behavior change. Three of these are necessary and probably sufficient: (1) intentions to perform a given behavior, (2) skills and abilities necessary to perform the behavior, and (3) the presence or absence of environmental constraints that would prevent someone from performing the behavior. Specifically, if a person intends to use a condom during every sexual act, has the skills to use a condom correctly, and has access to condoms when needed, there is an extremely high probability that the behavior will be executed.

## STD PREVENTION STRATEGIES

In designing STD prevention programs, multiple strategies have been used that reduce the risk of acquiring an STD:

- *Increase use of latex condoms or other barrier methods.* Consistently using latex condoms is the best way to avoid contracting most STDs, although they are not as effective with herpes.
- *Delaying sexual initiation.* If adolescents delay initiation of sexual behavior this can be very important in preventing early acquisition of STD infections. Young women in menarche are more susceptible to some STDs because of the lack of maturity of the cervix.
- *Reduce number of partners.* The greater the number of partners, the more likely an individual is to be exposed to a partner who is positive for one or more STDs.

- *Avoid risky partners.* Risky partners are more likely to have multiple partners, use injection drugs, not use condoms, and be positive for one or more STDs.
- *Refrain from sexual encounters during outbreaks or while contagious.* Even if a partner is positive for herpes, a person can be protected by not having contact during those periods. While a person is receiving treatment for an STD, if the couple is abstinent, then they can avoid passing the same STD to each other.
- *Reduce use of vaginal douching.* Women who douche frequently are at higher risk for later complications of STDs, such as pelvic inflammatory disease.
- *Regularly seek health care.* Early treatment can limit the time that someone is infectious and prevent some of the negative health consequences of having an STD.

## TYPES OF STD PREVENTION PROGRAMS

The three primary goals of both individual and population-based interventions are to prevent exposure to an STD, prevent acquisition of infection once exposed, and prevent transmission of the infection to others.

### Behavioral Interventions

To prevent further transmission and acquisition of STDs, the behavior of individuals must be changed. Individual behavior change can be affected by evidence-based (scientifically proven) interventions delivered at multiple levels: (1) individual, (2) couples, (3) family, (4) community, and (5) societal (policy and media) (Pequegnat & Stover, 2000).

It is also critical that the intervention be based on a theory to ensure that modifiable risk and protective processes are targeted by the intervention to affect the outcome. Interventions that are delivered at the five levels use different theoretical approaches. For example, individual and couples interventions have been based on social cognitive theory and are effective because they focus on perceptions of risk, skills building, and enhancing negotiation skills. The structural ecological model has been used effectively with families to restructure relationships within the family to enhance social support dynamics. The theory of diffusion of innovation posits that in every community there are popular opinion leaders who can be trained to deliver prevention messages during conversations

with friends and neighbors that will result in change in social norms about engaging in lower-risk behaviors (e.g., consistently using condoms) and ultimately in incidence of STDs (Kelly, 1999; Kelly et al., 1991; Rogers, 1983).

Prevention scientists must also consider the developmental level of the target population and match the intervention to the life experience of the target group. For example, an intervention aimed at preadolescents who are not sexually active should be prevention messages delivered by the parents encouraging delay of initiation of sexual behavior. Prevention programs for sexually active adolescents may also be delivered by parents, but it is also important to address the social norms and perception of behavior by peers in order to support safer HIV-related behaviors. An intervention designed for adults would focus on consistent condom use with all partners.

### Abstinence and Delay of Sexual Initiation

Some prevention programs have been developed for adolescents to maintain abstinence and prevent them from initiating sexual activity. Many of these programs are designed to be delivered to parents, who then deliver the prevention messages to their children (Pequegnat & Szapocznik, 2000). Other programs with similar goals have been delivered in schools. While many of these programs focus on preventing STDs, they may also result in pregnancy prevention.

### Prophylaxis

The only efficacious vaccine currently available is for hepatitis B. Although the hepatitis B vaccine has been available for more than a decade, few people have been vaccinated because a selective vaccination strategy was initially adopted and there has been little public information about the vaccine. Vaccines for herpes simplex virus are in clinical trials, and vaccines for other STDs are in various stages of development.

### Clinical Care Screening for Asymptomatic STDs

In addition to interventions designed to prevent STDs through behavior change or vaccines, there are interventions to reduce the duration of the infection. Many people are asymptomatic for STDs and therefore clinical screening programs are essential to identify individuals who are positive for an STD so they

do not transmit to their partners. Some opportunities for screening occur when people are seeking health services for medical clearance to play sports, seeking contraception and family planning services, having an annual health checkup, or having a health examination for life insurance. These health care visits may be optimal times because individuals are more likely to be receptive to STD prevention messages because they are already seeking health care.

### Early Treatment for Symptomatic STDs

Prevention campaigns that encourage health-seeking behavior for STD symptoms are important.

Early treatment for symptomatic people is essential to contain the contagion of STDs and prevent complications for STDs in infected individuals.

The STD treatment guidelines published by the Centers for Disease Control and Prevention (CDC; 1993) provide the current standards for therapy of STDs. A problem with treatment is the failure to adhere to the full course of medication. To address this problem, effective single-dose therapy for several STDs (e.g., chancroid, gonorrhea, syphilis, trichomoniasis) have been developed and single-dose therapy for chlamydia infection has recently become available. These single-dose regimens have been shown to be as effective as multiple-dose regimens (Zenilman, 1996). However, single-dose therapies can be significantly more expensive than standard multiple-dose medications.

Many viral STDs (e.g., HIV infection, genital herpes, hepatitis B virus infection) are being diagnosed as suppressible (not curable) infections with new therapies. These treatments suppress viral replication and thereby reduce transmission and may be considered to be a viable approach for preventing STDs.

### Partner Notification and Treatment

A partner notification program was initiated for syphilis after penicillin became widely available in the 1940s. This worked well for syphilis because there is a long incubation period (approximately 3 weeks but can be between 10 and 90 days from exposure to onset of symptoms) so it was possible to treat incubating syphilis.

When this approach was expanded to include the referral of partners exposed to other STDs, the strategy had to be changed because the incubation period for

gonorrhea (usually a week or less) and chlamydia (1 to 2 weeks) is too brief to prevent incubation. Therefore, the rationale for partner notification became locating and treatment of asymptomatic infected female partners of symptomatic men and on providing early treatment to prevent complications. Partner notification followed by partner treatment, therefore, is considered to be a strategy that benefits the individual patient, his or her partner, and the community as a whole.

When the model was applied to HIV/AIDS, there were other concerns because the incubation period is so long that it makes partner notification more difficult, the disease is very stigmatized, and there are not curative therapies. However, early intervention with anti-retroviral therapy and prophylaxis against opportunistic infections may be more beneficial if there is patient adherence.

### SUMMARY

While there are efficacious STD prevention and treatment programs, there are multiple barriers to successfully implementing them effectively in public health agencies. Individual factors, such as high-risk sexual behavior, misperception of risk, and lack of skills needed to negotiate and use condoms, increase risk of STDs. Factors that prevent persons from seeking health care for STDs, including lack of perception of risk, misinformation, lack of knowledge about STDs, and the social stigma of STDs, must be addressed by the public health system. Although newer laboratory tests have improved the screening and diagnosis process, expense and accessibility to these tests are major barriers to clinical diagnosis and treatment. Because of the variety of barriers that influence the risk for STDs, it is clear that both biomedical and behavioral interventions must be integrated in a national STD prevention campaign.

—Willo Pequegnat

See also AIDS AND HIV: PREVENTION OF HIV INFECTION;  
HEALTH PROMOTION AND DISEASE PREVENTION

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## SICKLE CELL DISEASE: PSYCHOSOCIAL ASPECTS

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Sickle cell disease (SCD) is an inherited disease that is found in people of African descent as well as those whose ancestry is from certain groups in India, the Middle East, and the Mediterranean. Its presence in Latin America is related to the intermingling of gene pools between people of African origin and the indigenous populations.

SCD is understood on a molecular, cellular, and clinical basis. The molecular problem is an abnormal structure of the hemoglobin molecule that causes the molecules to aggregate into well-ordered bundles within the red blood cells instead of remaining in solution as is usually the case. This abnormal aggregation or polymerization of hemoglobin molecules causes numerous abnormalities on the cellular level. The red cells' shapes are distorted by the presence of the polymers. There is physical disruption of the cell membrane causing both abnormal binding of the red cells to blood vessel walls and leakage of water and electrolytes from the cells. The red cells cause vaso-occlusion in the smallest blood vessels throughout the body, and are destroyed much more quickly than normal cells.

The immediate consequences of the cellular abnormality are anemia, because of the increased destruction, and pain and organ damage, due to vaso-occlusion. The clinical problems that result include fatigue and decreased exercise tolerance; episodes of acute, severe pain; sequestration of red cells in liver and spleen; and cumulative damage to organs, especially bones, kidneys, liver, lungs, and brain. There is also increased susceptibility to infection, particularly in children, who also have growth delay and the late onset of puberty.

There is a wide range of clinical severity in SCD, with some children having initial symptoms of pain in infancy and others not experiencing pain or other

complications until school years or later. Pain, which occurs in episodes of sudden onset, is the hallmark of the disease. This is acute, severe pain that can occur in any part of the body; the onset of pain episode is completely unpredictable. Most pain can be managed at home, using a combination of nonpharmacological measures such as heat, massage, rest, and distraction, along with medications. Nonsteroidal anti-inflammatory agents, acetaminophen and lower-strength opioid medications, are commonly used by patients at home. When these fail, medical attention is usually sought. Parenteral opioids are then given in a clinic, emergency room (ER), or inpatient setting. A major barrier to effective treatment of pain crises is lack of understanding on the part of ER personnel resulting in inadequate pain relief and unsympathetic care. Many individuals with SCD have no alternatives to ERs for treatment of pain episodes.

Other acute complications that occur in SCD are acute chest syndrome, a pneumonia-like illness that can be quite serious or even fatal; splenic sequestration, which causes a life-threatening worsening of anemia; acute, severe infections such as meningitis or bacteremia; and stroke. The chronic conditions, which are now being seen more frequently as people with SCD survive longer, include bone disease, renal insufficiency and failure, hepatic insufficiency, decline in pulmonary function, and leg ulcers. Despite the many potential problems associated with the disease, a majority of affected individuals have relatively few problems.

## MEDICAL TREATMENT

Medical treatment for acute pain episodes, as noted above, is primarily achieved with analgesics and anti-inflammatory agents at home. In hospitals, the most commonly used agents are parenteral morphine and meperidine, although there is an effort to greatly reduce or eliminate the use of meperidine because of the risk of significant toxicity with more than very short-term use. Morphine provides good analgesia when given appropriately, although the adverse effects of itching, oversedation with respiratory depression, nausea, and constipation have to be monitored and treated as necessary. Ensuring adequate hydration and oxygenation, and treating concomitant infections, are important adjuncts to analgesia. Emotional support and sympathetic nursing care are extremely important.

Transfusions are used for selected problems such as some instances of acute worsening of anemia, acute chest syndrome with respiratory insufficiency, acute stroke and secondary stroke prevention, some cases of pulmonary hypertension, and preparation for major surgery. Depending on the indication, the transfusions are either simple or exchange transfusions.

Preventive care for children with SCD includes the daily administration of penicillin to children under 5 years for the prevention of invasive pneumococcal infections, and yearly transcranial doppler exams of the intracranial arteries to assess for stroke risk. The standard childhood vaccines are of great importance; in addition, these children should receive influenza vaccine yearly, and continue to receive the older 23 valent pneumococcal vaccine as well as the newer conjugated pneumococcal vaccine, which is now standard pediatric care.

Hydroxyurea is now widely used in SCD. Chronic administration of this drug causes an increase in fetal hemoglobin production, and other less well understood effects that combine to ameliorate the course of the disease. It reduces the rate of painful crises, hospitalizations, and acute chest events and the requirement for transfusion all by 40% to 50%. In use for about 10 years in SCD, an increased rate of malignancy has not been observed; there is some evidence that it is associated with a lower death rate in those who use it. Although it has not yet been approved by the Food and Drug Administration in children, it is being used with similar effects as seen in adults.

Bone marrow transplantation using stem cells from an unaffected, matched sibling donor has a success rate of about 85% in children with SCD. These children are cured; their red cells contain normal hemoglobin. This has been performed in more than 100 children in the United States and in a slightly smaller number in Europe. There has not been great success in transplanting adults with SCD.

Research into new treatments is being carried out in a number of centers in the United States and abroad. Areas of investigation include new drug therapies, gene therapy, lessening the toxicity of stem cell transplantation, nutritional therapy, genetic investigation for better prognostication, and interventions for specific complications of the disease.

Although progress is being made in the medical care of people with SCD, there is still a great deal of disability and suffering that is associated with the disease. The psychological burden of a chronic disease is

significant at all ages, and psychosocial assessment and the provision of support and advocacy has long been part of comprehensive sickle cell medical care.

#### ACADEMIC AND PSYCHOSOCIAL SEQUELAE OF SICKLE CELL DISEASE

One of the most commonly cited consequences of SCD for children is impaired academic functioning as reflected in lower teacher evaluations, sub-par achievement, and grade retention (Barbarin, Whitten, & Bonds, 1994). Distraction due to pain, and interruption due to hospitalization, may place children at risk for poor academic performance. In addition, Brown, Armstrong, and Eckman (1993) suggest that subtle neurological deficits associated with cerebral vascular accidents affect cognitive processes and higher-order cognitive abilities and later impede learning and academic achievement. However, studies that control for socioeconomic status and other demographic features find no effect of SCD on IQ,<sup>1</sup> performance on standardized tests of reading and math, or grade retention (Midence, McManus, Fuggle, & Davies, 1996; Richard & Burlew, 1997).

Although children with SCD experience social and psychological stressors as sequelae of the disease, evidence of academic and psychological impairment is minimal once the effects of socioeconomic disadvantage are controlled. Although children with SCD are rated as less sociable and less well accepted than non-ill peers, no differences are found on indicators of emotional well-being such as depression and self-concept (Midence et al., 1996; Noll, Vanatta, & Koontz, 1996). The relationship between SCD is strong for adolescents but not young children (Barbarin, 1999; Lemanek, Horwitz, & Ohene-Frempong, 1994). In addition to problems with social functioning, adolescents with SCD face special difficulty in making the transition to independence. This may be because SCD is commonly accompanied by episodes in which one is almost helpless, as well as the other barriers experienced by chronically ill children and adolescents.

For adults, the sequelae of SCD include the experience of fear, guilt, loss of morale, and zest for life and a higher risk for marital dysfunction and chronic problems with employment, anxiety, and fear regarding body deterioration, and a lack of assertiveness in social situations (Barrett et al., 1988; Belgrave & Molock, 1991). Anxiety is provoked by the complete unpredictability of the onset of pain, and the intensity

of pain often causes individuals to fear that they will die during the crisis.

In work life, persons with SCD experience physical limitations such as decreased capacity for strenuous activity and lowered tolerance for extreme temperatures, high altitudes, dangerous toxins, and infectious environments. In addition to the limitations that restrict what a person with SCD can perform at work, there are a few other issues. Once having obtained a job, they often are fired because of absences due to illness. This is also an issue for the parents of children with SCD who miss work to take care of their sick child. In low-skill jobs there is little tolerance for sick days. Also, when one is paid by the hour, missing work means missed pay. Employability may be further compromised by the same social factors such as racial discrimination that affects employment of African Americans who do not have SCD (Utsey, 1991).

Then there is the issue of disability, which presents a complex dilemma for adults with SCD. Some individuals have qualified as being disabled simply by virtue of having SCD, while some have documented disabling conditions; of those who have disabling conditions, some work and others do not. Some children have qualified to have Supplemental Security Income grants and therefore approach adulthood with the label of *disabled* already in place. This almost certainly affects their self-image, life goals, and ambitions. This financial grant, small as it is, combined with difficulty in obtaining and maintaining employment often is a disincentive to do anything to shake off that label, even when the individual may be capable of working.

Life expectancy and quality for persons with SCD have improved measurably over the past decade. With good health care and preventive interventions, many live to old age. However, the psychosocial challenges of social stigma, anxiety, and poverty continue to make life difficult. Thus, the need for strong programs of socioemotional support is as great as ever.

—Oscar A. Barbarin, Rupa Redding-Lallinger, and  
Marcelle Christian Holmes

See also CHRONIC DISEASE MANAGEMENT; CHRONIC PAIN  
MANAGEMENT

#### Note

1. There is definite abnormal neuropsych performance by children with SCD who have had clinical strokes in

comparison to those with SCD who have "silent" lesions in CNS and those with normal CNS imaging (see Armstrong et al., 1996, *Pediatrics*, 97, 864-870).

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## SLEEP DISORDERS: BEHAVIORAL TREATMENT

Because thoughts, feelings, and actions can all have an impact on the quality of a night's sleep, sleep may be considered a behavior that is in part under conscious control of an individual. Psychology specializes in helping individuals modify their thoughts, feelings, and actions using a variety of techniques based on well-known principles. Behavioral sleep medicine is a field that has recently come into existence and focuses on the identification and treatment of those psychological factors that contribute to the development and/or maintenance of sleep disorders (Stepanski & Perlis, 2000). Behavioral sleep medicine specialists are typically psychologists who have completed a Ph.D. in clinical psychology or a related psychological area with appropriate training; the most advanced are board certified in sleep medicine. The behavioral treatment of sleep disorders focuses on the assessment and treatment of the complaint of insomnia, providing adjunctive therapy for sleep disorders that result in excessive daytime sleepiness, assessment and treatment of pediatric sleep disorders, and improving adherence with pharmacological and non-pharmacological treatments for sleep disorders.

### THE SLEEP DISORDERS

The most widely recognized sleep disorder classification system is the International Classification of Sleep Disorders (American Sleep Disorders Association, 1997). Sleep disorders are classified into dysomnias (sleep disorders that produce either insomnia or excessive sleepiness), parasomnias (undesirable

physical phenomena that occur predominantly during sleep), and those associated with medical or psychiatric disorders. Dyssomnias are the most common sleep disorders. Examples of dyssomnias that cause sleepiness include sleep apnea and narcolepsy; an example of a dyssomnia that causes insomnia is psychophysiological insomnia. Sleep apnea alone accounts for about 80% of all sleep disorder diagnoses.

Sleep disorders are prevalent in the United States, yet most individuals with sleep complaints have not been fully evaluated by a sleep professional. A National Sleep Foundation poll conducted in 2002 found that nearly one third of randomly selected Americans reported that their sleep quality was fair or poor. More than one half of the respondents reported having experienced at least one of four symptoms of insomnia at least a few nights per week. And over one third reported that they were so sleepy during the day that it interfered with their daily activities a few days per month or more. In fact, fully three fourths of respondents experienced at least one symptom of a sleep disorder a few nights per week or more. Perhaps the most important finding of the poll was that only a small fraction of those respondents who reported symptoms of any sleep disorder talked to a health care professional about the sleep complaint. In short, symptoms of sleep disorders are common in the United States and most of those with a sleep disorder have not been appropriately tested.

When someone is suspected of having a sleep disorder, they are typically referred to an accredited sleep disorders clinic. Accredited sleep disorders centers are those clinics that have met rigorous standards and passed a strict evaluation from the American Academy of Sleep Medicine. Sleep disorders are diagnosed and treated by many different health care professionals, including general practitioners and specialists in neurology, pulmonary medicine, psychiatry, psychology, pediatrics, and dentistry as well as other fields. Larger sleep centers have several of these specialists on staff who will consult with each other on the appropriate diagnosis and treatment for any one individual. For example, a patient who complains of insomnia could be started on a sleep-promoting medication by a neurologist or psychiatrist while a behavioral sleep medicine specialist begins to help the patient learn how thoughts, feelings, and actions are contributing to sleep difficulties.

Typically, the patient will undergo an interview with a sleep professional and then have his or her

sleep monitored while sleeping in the center. Electroencephalography, electro-oculography, and electromyography allow the recording of brain activity, eye movements, and chin muscle activity, respectively, so that the stage of sleep may be identified. Other parameters that may be recorded include airflow, breathing effort, oxygen level, body position, leg movements, heart rate, and snoring level. Sleep consists of non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. NREM sleep consists of Stages 1 through 4, with Stage 1 being transitional sleep and Stages 3 and 4 consisting of “deep” sleep, which is considered the most restful. About 50% of the night is spent in Stage 2 sleep. REM sleep is the stage during which dreaming takes place and occurs about every 90 minutes during sleep. People cycle through these stages in characteristic ways. Sleep disorders often result in a disruption of these sleep stages; for example, sleep apnea results in many frequent awakenings from sleep such that a disproportionate amount of time is spent in Stages 1 and 2, which leads to inadequate sleep and subsequent excessive daytime sleepiness. Narcolepsy is characterized by entering REM sleep rather than Stage 1 sleep.

## GOOD SLEEP HYGIENE

The foundation of all behavioral treatments of sleep disorders rests on the “good sleep hygiene” habits listed in Table 1. Some or all of these recommendations can play a role in the reviewed sleep disorders. However, these good sleep habits alone typically are not sufficient for the appropriate treatment of sleep disorders. A behavioral sleep medicine specialist will help identify the two or three most important behaviors to change and develop a treatment plan to implement these changes, in conjunction with the patient. These habits can be classified according to health practices (i.e., diet, exercise, and substance abuse) and environmental influences (i.e., light, noise, temperature, and mattress).

## BEHAVIORAL TREATMENT FOR INSOMNIA

Insomnia is a complaint of insufficient sleep and is not a disorder itself. There are three types of primary insomnia including psychophysiological insomnia, idiopathic insomnia, and sleep-state misperception and several types of secondary insomnia including insomnia associated with psychiatric disorders or insomnia



**Table 1** Good Sleep Hygiene Habits

1. Sleep only when sleepy or drowsy. If unable to fall asleep or stay asleep, leave the bedroom and engage in quiet activity elsewhere. Return to bed when—and only when—sleepy.
2. Avoid caffeine within 4 to 6 hours of bedtime and avoid the use of nicotine close to bedtime or during the night.
3. Do not drink alcoholic beverages within 4 to 6 hours of bedtime.
4. Get regular exercise each day. Refrain from strenuous exercise at least 4 hours before bedtime.
5. Establish regular bedtimes and uptimes, even on days off work and on weekends.
6. Avoid looking at the alarm clock at night.
7. Avoid napping during the daytime. If daytime sleepiness becomes overwhelming, limit nap time to a single nap of less than 1 hour, no later than 3 p.m.
8. Develop sleep rituals.
9. While a light snack before bedtime can help promote sound sleep, avoid large meals.
10. Minimize light, noise, and extremes in temperature in the bedroom.

associated with medical disorders. Sleep-state insomnia is a condition whereby the patient's complaint is not corroborated by polysomnographic recording. Psychophysiological insomnia is considered a learned insomnia; for example, a patient may not be able to fall asleep within a reasonable amount of time in his or her own bed, yet fall asleep quickly when in a hotel room. Idiopathic insomnia is typically diagnosed when no known cause can be identified. These types of insomnia can be classified according to whether they are transient, acute, or chronic.

Spielman and colleagues (Spielman, Caruso, & Glovinsky, 1987) developed a useful theoretical framework to help understand the complex interactions among the many factors that may be involved in the complaint of insomnia. *Predisposing* factors include those factors (including emotional, cognitive, or behavioral) that promote insomnia but are insufficient alone to cause insomnia without the presence of other factors. For example, individuals who are worriers would be considered to be at higher risk for insomnia. *Precipitating* factors are often identifiable events that precede insomnia (e.g., something major such as death of a loved one or minor such as sleeping in an unfamiliar bed). *Perpetuating* factors are behaviors that help to maintain sleeplessness once it has begun and are typically learned during episodes of insomnia. These include irregular sleep habits (e.g., monitoring the clock) that might lead to performance anxiety. Performance anxiety occurs when an individual puts extra pressure on himself or herself to fall asleep, which usually has the effect of delaying sleep onset.

Behavioral treatments are aimed at reducing factors that perpetuate insomnia. Techniques include

relaxation techniques, stimulus control therapy, sleep restriction therapy, and cognitive-behavioral therapy. Relaxation therapy helps to reduce physiological tension and is typically used in conjunction with other treatment techniques. Stimulus control therapy attempts to break the learned association between the feeling of being awake in one's sleep environment by teaching one to (1) be in the bedroom only when drowsy or asleep and (2) not to engage in behaviors incompatible with sleep in the bedroom (e.g., paying bills or dealing with problems). Sleep restriction therapy attempts to help one increase the drive for sleep by partially depriving sleep. A schedule of strict bedtimes and uptimes is prescribed to help consolidate sleep and decrease the amount of time spent awake during the night. Cognitive-behavioral therapy (CBT) focuses on helping to change unrealistic beliefs or irrational fears about sleep. CBT is the most widely studied approach and typically incorporates each of the described techniques.

How effective are behavioral interventions for insomnia? Several meta-analyses have been published comparing behavioral treatment of insomnia with pharmacological treatment (Morin, Culbert, & Schwartz, 1994; Murtagh & Greenwood, 1995; Smith et al., 2002). They found that behavioral treatment of insomnia produced reliable and durable changes in the sleep of patients and that behavioral treatments produced similar short-term outcomes as that of pharmacotherapy. Pharmacotherapy for insomnia is thought to be limited for use over the long term because it may result in tolerance, dependence, or rebound insomnia upon discontinuation. Behavioral treatment of insomnia has the benefit of few, if any, side effects. Stimulus

control and sleep restriction are the most effective single behavior therapy procedures, whereas sleep hygiene education and relaxation alone do not appear to be effective but are important adjunct treatments.

#### ADJUNCTIVE THERAPIES FOR SLEEP DISORDERS ASSOCIATED WITH EXCESSIVE DAYTIME SLEEPINESS

Behavioral sleep medicine specialists can play an important role in providing adjunctive behavioral treatments for sleep disorders associated with excessive sleepiness.

Obstructive sleep apnea is a sleep disorder characterized by repeated cessations of breath at night, which result in sleep fragmentation, lowered oxygen saturation levels, excessive daytime sleepiness, and cardiovascular consequences. Obstructive sleep apnea is often worsened when sleeping in the supine position. Behavioral treatments geared toward encouraging sleep in the nonsupine position (1) may provide a simple and effective primary treatment for mild to moderate obstructive sleep apnea in some patients and (2) can improve the effectiveness of other treatments for apnea (e.g., by increasing the efficacy of continuous positive airway pressure devices).

Narcolepsy is a sleep disorder characterized by an uncontrollable urge to fall asleep that is associated with muscle weakness. Narcolepsy is composed of four key symptoms: excessive daytime sleepiness; cataplexy (sudden loss of voluntary muscle control, usually triggered by emotions such as laughter, surprise, fear or anger); hypnagogic hallucinations (vivid, realistic, often frightening dreams); and sleep paralysis (a temporary inability to move). Behavioral sleep medicine practitioners play an important role in the management of narcolepsy by helping to schedule daytime naps (Mullington & Broughton, 1993). By scheduling naps, patients with narcolepsy can have a reduced incidence of cataplexy and improved daytime functioning, thereby improving their overall quality of life.

Finally, adjunctive behavioral treatment for sleep disorders may involve treating psychiatric symptoms and/or disorders that are associated with primary sleep disorders. For example, patients with insomnia may have anxiety symptoms, and obstructive sleep apnea patients may have depressive symptoms that cognitive-behavioral treatment can help ameliorate.

#### PEDIATRIC SLEEP DISORDERS

Several pediatric sleep disorders are amenable to behavioral treatments including nocturnal enuresis, limit-setting sleep disorder, and sleep onset association disorder (Ferber, 1985). Detailed behavioral sleep medicine treatments have been described for nocturnal enuresis including the “bell and pad” technique (Houts, Liebert, & Padawer, 1983) and for bedtime refusal problems including extinction procedures (Adams & Rickert, 1989; France & Hudson, 1990).

#### ADHERENCE TO MEDICAL TREATMENT

Evidence is accumulating that shows the effectiveness of behavioral treatments in treating medical adherence issues with sleep disorders. For example, continuous positive airway pressure treatment (CPAP) for sleep apnea is cumbersome and can be a difficult treatment to adjust to and use over the long term. Modifiable factors associated with adherence include perceived self-efficacy, social support, and education. Self-efficacy refers to the belief that an individual can engage in the desired behavior or perform the desired task. Cognitive-behavioral treatments focusing on perceived self-efficacy, social support, and education can increase adherence rates modestly. Patients who have phobic or anxious reactions to using CPAP are appropriate candidates for systematic desensitization procedures. Systematic desensitization is an effective cognitive-behavioral treatment that attempts to substitute an anxious response with a pleasurable response.

#### CONCLUSIONS

1. Sleep disorders are common, and most individuals in the United States have not discussed their sleep problem with their physician or been fully evaluated.
2. Behavioral treatments for sleep disorders are playing an increasingly important role in sleep disorders centers.
3. Comparative data suggest that CBT is associated with effects equal to that of pharmacotherapy in the short term, and greater, longer-lasting benefits than pharmacotherapy in the long term. Motivated, adherent patients are important to achieving these treatment gains.

—Carl J. Stepnowsky Jr.

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## SMOKING AND HEALTH

People smoke in order to obtain a "hit" with nicotine. The reward from smoking occurs when nicotine, absorbed into the general circulation from the lungs, meets nicotine receptors in the brain. Smoking

tobacco in the form of cigarettes provides a very efficient drug delivery system for nicotine. The problem is that more than 4,000 other compounds enter body tissues, many of them extremely toxic. Smoking is the most common cause of preventable death worldwide. In developed countries where the smoking epidemic took hold early, roughly a quarter of male deaths and about 7% of female deaths are due to smoking (Peto, Lopez, Boreham, Thun, & Heath, 1994). Elsewhere information on tobacco and health is less reliable, but it is estimated that there are currently around 4 million deaths a year worldwide due to smoking.

As the effects of growing numbers of smokers in countries such as China become apparent, attributable deaths are bound to rise, perhaps as high as 10 million a year by the middle of the 21st century. But we know the problem is preventable. Smoking and diseases due to smoking are both waning in many countries. For example, tobacco consumption per head of population has been halved in the past 25 years in New Zealand. From its peak in the 1960s, the smoking death rate has fallen by almost 50% in middle-aged men in the United Kingdom.

This entry describes patterns of smoking worldwide, summarizes the ways in which smoking causes ill health, and reviews what is known about interventions to prevent tobacco-induced diseases and premature deaths.

### WHO SMOKES?

Cigarettes are by far the most common form of smoked tobacco worldwide, although in some regions hand-rolled cigarettes, bidis, cigars, and pipes are also popular. Roughly a billion people are regular smokers (about 30% of the world adult population). Men are more likely to smoke than women although recent surveys in some countries show that smoking by young women and girls is rapidly becoming more common. With relatively few exceptions, the addiction to nicotine begins in adolescence and most current adult smokers were regular smokers by their 18th birthday. Otherwise, the pattern varies widely. For example, among men, there is more than a twofold difference in smoking prevalence between sub-Saharan Africa, the region with the lowest prevalence, and East Asia, with the highest. Smoking among women is still uncommon in South Asia (about 1-4%) although increasing, but prevalence is over 20% in Latin America and the Caribbean.

In most high-income countries, smoking is becoming less common, chiefly due to an increasing number of smokers successfully quitting. In low-income countries, prevalence ratios are still rising, especially among men. Differences in smoking prevalence are apparent within most countries by socioeconomic status and ethnicity. The most common pattern is higher smoking prevalence in less advantaged social groups. However, this is not universal—in some parts of the world, particularly where the rise in smoking prevalence is relatively recent, the social gradient in smoking is either flat or indicates that more advantaged groups are trend-setters. Over and above socioeconomic differences, higher smoking levels are commonly observed among minority ethnic groups.

#### HOW DOES SMOKING AFFECT HEALTH?

Early reports on the health risks of smoking, in Germany before 1940 and subsequently in the United Kingdom and the United States, concentrated on lung cancer. This caught the attention of researchers because it is an uncommon condition in nonsmoking populations, with a distinctive and severe clinical presentation. The increased risk due to smoking depends on amount smoked, pattern of smoking (inhaling or not), and duration of smoking. It is not clear whether the risk for women differs from that for men, for the same smoking history. Cigarette composition very likely affects the risk of cancer and other health problems, but the details are not fully understood. However, because of increased or “compensatory” smoking, users of low-tar and low-nicotine cigarettes are probably not at an appreciably lower risk of cancer or other problems such as heart and lung disease.

Since the first reports on lung cancer, the list of conditions associated with smoking has increased considerably. The only cancers known to occur less commonly in smokers are endometrial cancer (in postmenopausal women) and possibly, thyroid cancer. These effects may be due to the antiestrogenic actions of smoke constituents. Otherwise, there is strong evidence of cancers caused by smoking ranging from cancer of the mouth, larynx, and esophagus to cancers of the large bowel, kidney, and bladder.

Smoking is associated also with more than 20 non-malignant diseases and health problems. In high-income countries, more deaths result from vascular diseases caused by smoking than all cancers combined. The increased risk for a smoker is relatively

less than for lung cancer because other causes of heart disease (such as high blood pressure and cholesterol) are widespread. But heart disease and stroke are the predominant causes of death in many parts of the world, so they contribute the bulk of smoking deaths. The mechanisms by which smoking affects vascular disease are being gradually unraveled, and it appears they include both “early” effects on the lining of blood vessels and relatively “late” effects on clotting and platelet function.

Smoking damages the reproductive system of both males and females. In men, low sperm counts, damaged sperm, and impotence are common findings. In women, there are increased risks of delay in conceiving, permanent infertility, and increased incidence of cervical cancer. There is a risk of more frequent preterm delivery if mothers smoke during pregnancy, and a higher proportion of low birth weight babies. Infants of smoking mothers have a worse health experience and more admissions to hospital during the first year of life. Smoking increases substantially the risk of heart and vascular disease associated with oral contraceptive use, and among older women, is associated with low bone density and hip fracture.

Passive smoking, breathing in other people’s smoke (second-hand smoke), has long been regarded as a source of annoyance, but was first identified as a hazard to health in the 1972 Office of the Surgeon General’s report. Very strong harmful effects are found in children, who are more than twice as likely to suffer chest infections and other serious respiratory problems if their parents smoke. Adult nonsmokers exposed to smoke in the home or at work also have a much increased risk of bronchitic symptoms (such as cough, phlegm, and wheeze), illness episodes with time off work, and increased health care costs. Nonsmoking adults with second-hand smoke exposures are more likely to develop lung cancer and coronary heart disease. For any individual, the risks associated with passive smoking are of course less than those due to active smoking, but large numbers of nonsmokers are exposed, resulting in a large burden of illness. The fact that the exposure is involuntary has given the health effects of passive smoking particular prominence in tobacco control.

Despite the wealth of studies on the topic, there remain important unanswered questions about the effects of smoking on health. Further work is needed on how the findings in countries such as the United States and the United Kingdom can be extrapolated to

settings with quite different social and health profiles. Recent studies in low-income countries have shown that smoking tends to amplify their common causes of death, such as chronic lung disease and tuberculosis in China and India. As the epidemic progresses, however, cancers and heart disease will also become important in developing countries.

Ways in which smoking interacts with other risk factors are not well understood but are important in understanding the present distribution of disease and projecting future trends. For example, lower heart disease rates in heavy-smoking Asian populations compared to the West have raised the question of whether dietary factors may modify some of the effects of smoking. There is a great deal of interest also in the question of genetic susceptibility, focusing particularly on variants in the genes responsible for activating and detoxifying chemical carcinogens found in cigarette smoke. Some studies suggest that some genetic variations do increase susceptibility to the effects of active and passive smoking. However, the work is in its early stages.

#### HOW DO WE REDUCE THE DAMAGE CAUSED BY SMOKING?

Just as malaria prevention depends on control of the mosquito as the disease vector, so the prevention of smoking-related conditions depends on curbing the activities of the tobacco industry, principally the recruitment of young people of all ages to nicotine addiction. This is a formidable task. The tobacco industry spends many times the public health budgets of most countries to attract adolescents and young adults to use its products. In 1998, for instance, in the United States alone, the industry spent \$18 million a day marketing cigarettes. The efforts of the industry extend beyond public advertising. Court action by states' attorneys general in the United States in the 1990s aimed to recover Medicaid expenditures. It also made public millions of previously confidential industry documents, and these describe in detail ways in which the industry has sought to undermine research and obstruct health policies that threaten its commercial interests (Glantz, Slade, Bero, Hanauer, & Barnes, 1996). Unless these activities of industry are countered, efforts to prevent disease will very likely have limited success. Restrictions on advertising, sponsorship, and other forms of industry promotion make up the first step toward a comprehensive tobacco control program.

Educational interventions to discourage new smokers include face-to-face programs (such as those included in school curricula) and mass media activities. Both kinds of activity have been shown to reduce uptake, especially if part of a wide-based and sustained program that engages parents and communities. But the effect is generally short term, which is not surprising since educational activities of this kind generally operate in the face of environmental factors that are powerful promoters of smoking. Pervasive advertising and sponsorship, exemplified by strategic product placement in popular films, shape young people's understanding of tobacco and their attitudes toward the use of tobacco products.

Another consideration is the availability of tobacco products. Measures known to reduce the supply to minors include setting a minimum age for purchase of cigarettes, licensing and training vendors, restricting locations of vending machines, and ensuring there is visible enforcement of such legislation. Comprehensive and enforceable legislation is an essential component of tobacco control.

Clinical interventions to increase smoking cessation include simple advice to quit, intensive education and counseling, and treatment of nicotine addiction with different types of nicotine replacement therapy. On its own, advice has a small effect, but may reach a large number of smokers, especially when provided by family doctors or other health professionals who have contact with a large proportion of the population. Among all preventive activities in medical practice (including screening for cancers and treatment of high blood pressure), smoking cessation is the most cost-effective. Intensive educational interventions increase the quit rate but reach many fewer smokers. Treatment of nicotine addiction also improves outcomes, especially when combined with counseling, though at increased cost, including possible side effects.

It is unclear whether the redesign of cigarettes to create "safer" products has much to offer disease prevention. In the past, low-tar and low-nicotine cigarettes were promoted as safer alternatives, but there is no evidence to support these claims. Little is known about the health effects of the many additives introduced into cigarettes to improve taste and combustion properties and absorption of nicotine. On the basis of the consumers' right to know what they are purchasing, there are strong grounds for requiring full disclosure of contents and toxicity of all the constituents of cigarettes. It is telling that tobacco is not covered by

legislation concerned with safety of food, drugs, and other potentially hazardous substances—an anomaly that may be due in part to the long history of tobacco use, but is largely a consequence of sustained political pressure from the industry.

Restrictions on smoking in workplaces and in public settings reduce the exposure of nonsmokers to second-hand smoke. Studies have shown that these restrictions also cut the consumption of tobacco by smokers and increase cessation rates. Smoke-free environments have achieved wide acceptance, among smokers as well as nonsmokers, in many countries including the United States, Australia, and New Zealand. Exposure to second-hand smoke in the home, the major hazard for the most vulnerable group, children, is less susceptible to control by regulation.

Price has a strong influence on demand for tobacco products, especially among adolescents and young adults. Consequently, taxation is regarded as an important component of tobacco control. Sources of contention include effects on equity (since the tax affects mostly heavy-smoking, low-income groups) and over whether tax revenue matches the public costs of tobacco use. Revenue replacement, not necessarily the most important reason for taxing tobacco, depends on how ill health due to smoking is costed. However, the World Bank estimates that there is a large net loss from tobacco use worldwide.

## CONCLUSIONS

The challenge is twofold: first, to reduce the frequency of tobacco-induced diseases in the population overall, and second, to reduce inequalities in ill health caused by tobacco. The two goals may require different strategies, since whole-population interventions do not always work well for subgroups. For example, if smoking cessation programs are provided solely through mainstream health services, this is likely to disadvantage minority groups that find it difficult to access these services for cultural, economic, or social reasons. Similar arguments apply to tobacco control at an international level: The goal ideally is to reduce consumption without increasing disparities between countries. Greatest savings in the medium term will be achieved by increasing quit rates while benefits of reducing initiation to nicotine addiction will not become apparent until the second half of this century.

Comprehensive tobacco control programs offer the greatest potential for reducing smoking and preventing

disease, due to the combined effects of education, regulation, economic incentives, and support for cessation. A good fit with the local context is key to the successful implementation of health promotion, but at the same time the most powerful forces promoting tobacco use are transnational companies. This means that tobacco control must include a mix of local and international activity. An international focus is particularly important since almost 90% of the increase in tobacco-attributable deaths between 1990 and 2020 will occur in low-income countries.

A global strategy for the prevention of the tobacco epidemic is now in progress under the World Health Organization's Framework Convention for Tobacco Control (FCTC). It has the tacit support of the 194 member countries of the World Health Assembly, but within this group there are many vested interests that seek to water down or derail the process.

—Alistair Woodward and  
Anthony Hedley

See also CANCER AND SMOKING; HEART DISEASE AND SMOKING; SMOKING AND NICOTINE DEPENDENCE; SMOKING AND NICOTINE DEPENDENCE: INTERVENTIONS

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## SMOKING AND NICOTINE DEPENDENCE

Cigarette smoking is now well accepted as the leading cause of preventable death in the United States. The latest statistics reveal that about 3 million

smokers worldwide die annually from smoking and that the rapid increase in smoking in developing countries will cause this annual toll to rise to about 10 million by the year 2030. Several hundred million adults who are current smokers are expected to die from smoking, most often from chronic diseases of the heart and lungs. And one in five deaths in the United States is smoking related. Even among nonsmokers, exposure to secondhand smoke causes an estimated 3,000 deaths per year. Although the harmful health effects from smoking are widely known, only an estimated 3% of smokers successfully quit each year, less than 10% of those who attempt smoking abstinence. Thus, the current and future public health impact of smoking warrants greater effort being paid to understanding and treating nicotine dependence.

#### THE CASE THAT NICOTINE IS ADDICTIVE

Much of the debate regarding why people continue smoking in spite of its negative health consequences centers around the argument of whether or not, like other drugs of abuse, nicotine is addictive. When we talk about the addictiveness of a drug, we are referring to the ability of that substance to produce dependence. This is also termed *abuse liability*. No single task can accurately determine the addictiveness of a drug; rather, it is a preponderance of evidence across various criteria that leads to conclusions regarding a drug's abuse liability. Therefore, we consider three hallmark criteria for determining a drug's addictiveness as they apply to nicotine: (1) self-administration, (2) persistent inability to quit, including continued use despite known harmful consequences, and (3) concordance of use patterns between nicotine and "classic" drugs of abuse.

Self-administration is defined as the extent to which a drug is consumed more frequently than "placebo," or a concurrently available and similar substance that does not contain a drug. In a series of studies that dramatically increased attention on the influence of nicotine, researchers demonstrated that smokers would respond more on a choice lever to receive intravenous infusions if the infusions contained nicotine than if they contained only saline. Past studies have also shown that manipulating the amount of nicotine in cigarettes generally produces alterations in smoking behavior that appear intended to maintain a certain amount of nicotine intake. For example, decreasing the amount of nicotine per cigarette tends

to produce an increase in smoking behavior. That is, people smoke more, drag harder, and so on, when availability of nicotine is reduced in their cigarettes. However, increasing nicotine availability per cigarette decreases smoking behavior. This demonstrates that smokers self-regulate the amount of nicotine they ingest, not necessarily the number of cigarettes they smoke or puffs they take. Further evidence, albeit indirect, of the importance of nicotine in maintaining smoking behavior comes from the failure of nonnicotine cigarette brands to be successful in the marketplace. This fact mirrors the interesting experimental observation that complete removal of nicotine from cigarettes results in "extinction," or a nearly complete cessation of smoking behavior, in nonhuman primates trained to smoke tobacco.

Self-administration of nicotine from cigarettes is so persistent that smokers continue to smoke despite its known harm. Statistics illustrating the harmful effects of smoking and its links to various diseases are readily available. Indeed, since 1965 the Office of the Surgeon General has required that all cigarette packages contain a warning about the negative health consequences that may result from smoking. Regardless, 25% of all Americans continue to smoke, down only moderately from a prevalence of about 40% in 1965. However, perhaps even more compelling as evidence that smokers continue to smoke in spite of known negative consequences are the findings from past research demonstrating that 49% of women with a diagnosis or recurrence of lung cancer return to daily smoking, similar to the 50% of smokers who relapse following surgery for lung cancer. Clearly, even those who are undeniably aware of the negative consequences of smoking and have the most salient health reasons to quit continue to smoke.

Finally, how does nicotine compare with other self-administered drugs of abuse? Although nicotine use is in some ways very different from other drugs, epidemiological research has shown that the proportion of "ever users" of a drug who subsequently become dependent on that drug is greater for nicotine (32%) than for any other, including alcohol, heroin, or cocaine (15%, 23%, and 17% respectively). Furthermore, many if not most users of alcohol, marijuana, and other drugs are "casual users," able to consume these drugs infrequently or in moderation, and often able to stop their use with little difficulty. On the other hand, "nondependent" use of cigarettes characterizes fewer than 10% of smokers, with the vast majority

of smokers meeting criteria for nicotine dependence and unable to stop its use. With regard to cessation rates, the likelihood and time course of relapse back to smoking after quitting appear very similar to relapse back to alcohol, heroin, or other drug use after treatment. At least 80% of all smokers either have tried to quit or have not tried but want to quit, yet fewer than 10% will be successful in any given year. Even with intensive behavioral counseling, pharmacological assistance, or both, success rates for smoking treatment programs rarely exceed 30%. This means that more than two thirds of those trying to quit smoking fail even with substantial professional assistance.

Considering the preponderance of evidence, nicotine easily meets the hallmark criteria for determining drug addictiveness. Clearly, individuals self-administer nicotine more frequently than nondrug substances, they continue to smoke even in the face of known health consequences, and the persistence of use and difficulty quitting is at least as great with smoking as with other drugs of abuse.

#### NOVEL MEANS OF DELIVERING NICOTINE

When one accepts that nicotine is addictive, the seemingly contradictory notion arises that if nicotine is addictive, why are people addicted to cigarettes but not nicotine-containing products like the patch or gum? The answer to this question lies in the speed with which cigarettes, versus patch or gum, deliver nicotine to the brain. Smoking a cigarette delivers nicotine to the brain within 20 seconds, as rapidly as intravenous infusion. This quick uptake of nicotine following a puff is key to the reinforcing effects of cigarette smoking. On the other hand, therapeutic forms of nicotine, such as the patch and gum, generally deliver nicotine to the brain within several minutes or hours. These methods of nicotine delivery fail to be addictive, mainly because of the slow speed with which they deliver nicotine to the brain, which renders the drug less reinforcing.

#### EFFECTS OF NICOTINE

Having determined that people readily self-administer nicotine, have trouble keeping their use at low levels, and repeatedly fail in attempting to quit, the next question of course is, Why? Nicotine has a number of relatively modest, acute behavioral and subjective effects, depending, not surprisingly, on dose and

speed of uptake. Generally speaking, human research has shown that nicotine often increases subjective measures associated with drug "liking," "head rush," and "euphoria." However, it is important to reiterate that these effects are generally observed only with nicotine delivery systems producing rapid uptake of nicotine into the brain, like cigarettes, intravenous infusion, and nasal spray, and that the same doses delivered by slower means, like patch or gum, produce minimal or even aversive effects. These subjective effects of nicotine likely stem from the influence of nicotine on increasing brain levels of dopamine, norepinephrine, and acetylcholine, among other neurochemicals associated with pleasure systems in the brain.

While positively reinforcing effects of nicotine, such as acute responses, may help explain why people get started smoking in the first place, nicotine also provides negatively reinforcing effects in more experienced smokers that may explain its remarkable persistence, as noted previously. Following brief abstinence from smoking (e.g., overnight), most regular smokers experience characteristic tobacco withdrawal signs and symptoms, including restlessness, dysphoria, fatigue, difficulty concentrating, tension, impaired psychomotor function, jitteriness, irritable mood, and cough. Nicotine intake via smoking, and to a lesser extent by nicotine replacement products, reverses this withdrawal, thereby providing additional reinforcement to continue smoking. This negative reinforcement, coupled with the positively reinforcing effects of nicotine, provides some understanding of the strong persistence of tobacco smoking.

#### CONTRIBUTIONS OF CUES TO SMOKING REINFORCEMENT

Although the negative reinforcing properties of nicotine withdrawal might play a key role in the continuation of smoking behavior, past research has demonstrated that withdrawal from nicotine does not appear to be the sole cause of many smokers' inability to quit or their continuation of use. This seems particularly true when one considers that most smokers who achieve prolonged abstinence (> 1 month), beyond the time when withdrawal has abated, return to smoking.

Several theories purport that learning, or conditioning, might be one of the alternative factors responsible for both the perpetuation of smoking behavior and the initiation of relapse. That is, aside from the effects of nicotine per se, environmental events commonly paired



with nicotine intake can become cues able to strongly influence nicotine or smoking self-administration in animals and humans. Indeed, there is a wealth of research demonstrating that smokers react to cues linked with past smoking behavior. Take, for example, a smoker's daily smoke break at work as a cue. A smoker might learn to associate break time, the environment where it takes place, and, undoubtedly, his or her cigarettes with smoking (classical conditioning), or learn that smoking offers a much needed reprieve from hard work (operant conditioning). Through repeated pairing of one's break time with smoking, exposure to this cue/environment alone leads to strong reactivity such as subjective craving, physiological changes, and drug-seeking behavior. This conditioning holds fast, so that even long after the smoker has quit, these cues might serve to motivate smoking behavior.

#### INDIVIDUAL DIFFERENCES

The risk of becoming a smoker and the difficulty in quitting might also be linked to individual differences, particularly related to comorbid psychiatric diagnoses. Nicotine dependence rates are exceptionally high among individuals diagnosed with such illnesses as depression, schizophrenia, and alcoholism. This finding has led to contemporary research examining the mechanisms that might be associated with elevated levels of dependence among clinical populations. These studies examine the possibility that nicotine may serve additional "palliative" functions in these populations, over and above the dependence-producing effects noted previously. For example, nicotine may help alleviate negative mood or focus attention, functions that may be very reinforcing in those with depression or impulsive disorders. Moreover, genetic research has shown that nicotine dependence is highly heritable (inherited), to about the same degree as alcoholism. Thus, specific genetic factors may influence the degree to which nicotine intake is reinforcing in individuals, affecting the likelihood of subsequent onset of dependence and/or inability to quit. In addition, considerable research continues to examine variations in nicotine response as a function of personality traits, sex, family history, and combined abuse of other substances. Overall, these associations are leading researchers toward a clearer understanding of the underlying mechanisms of nicotine dependence and use, as well as the role individual differences might play in these processes.

#### IMPLICATIONS FOR TREATMENT

Contemporary approaches to treating nicotine addiction have largely taken advantage of advances in pharmacotherapy, or medication approaches to treatment. The most popular of these is nicotine replacement therapy (NRT). NRTs, such as the patch and gum, were designed to maintain individual nicotine levels through nonaddictive, less harmful means of drug administration. The premise of this treatment centered around the belief that not having to contend with strong physiological withdrawal while attempting to refrain from smoking cigarettes would make quitting much easier. During NRT, ex-smokers are stepped down gradually, reducing nicotine intake over several weeks rather than all at once, as is the case with going cold turkey. Presumably, this method eliminates acute withdrawal, which makes giving up nicotine and smoking more bearable.

Although this pharmacological approach to treatment has aided many smokers in quitting, it has failed to be the panacea of smoking cessation. The most common reason NRTs fail is that they have little or no impact on reducing smokers' reactivity to salient drug cues. As introduced earlier, smokers' reactivity to cues associated with past smoking can serve to initiate lapse or even relapse to smoking following abstinence. A second, often overlooked, reason NRT fails is that smokers get incomplete or erroneous instructions on how to use such products. Without proper instructing, either because of a failure to read instructions and follow them correctly, or negligence on the part of care workers to offer it, smokers often misuse NRTs, leading to underdosing and/or inflated expectations about the benefits of NRTs. Last, studies have shown that NRTs and counseling (e.g., cognitive-behavioral approaches) are equally effective in increasing smoking cessation rates. However, treatments incorporating both techniques are significantly more effective than either alone. Therefore, it is clear that consideration of both the physiological and psychological components of nicotine addiction must be addressed within treatment for cessation attempts to be most successful.

#### SUMMARY

Over the past 20 years, scientific studies have clearly established the link between smoking and negative health consequences, as well as the addictive

nature of nicotine. Here we have reviewed the hallmark criteria by which the abuse liability of all drugs are evaluated, and demonstrated why nicotine can be classified as an addictive substance. We have also made the case that nicotine addiction can be best understood through consideration of not only its physiological properties but in light of individual differences and the influence of conditioned cues as well. Past research has demonstrated that each of these factors might play a key role in the continuation of smoking as well as the inability of many smokers to quit. In fact, treatments that address both physiological and psychological factors have been shown to be most effective in helping smokers quit, thus further supporting the importance of adopting this joint approach in both understanding and treating nicotine addiction.

—Cynthia A. Conklin and  
Kenneth A. Perkins

See also HEART DISEASE AND SMOKING; SMOKING AND  
HEALTH; SMOKING AND NICOTINE DEPENDENCE:  
INTERVENTIONS

### Further Reading

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## SMOKING AND NICOTINE DEPENDENCE: INTERVENTIONS

Cigarette smoking is the leading preventable cause of illness, death, and disability in the United States, causing more than 430,000 deaths in the United States each year. Despite the enormous health consequences associated with smoking, 48 million adult Americans continue to smoke cigarettes (Centers for Disease Control and Prevention [CDC], 1999).

Nicotine, the psychoactive substance in tobacco, is a highly addictive substance that may control significant aspects of a person's behavior. It shares a number of common factors with the other recognized euphoricants (i.e., cocaine, opiates, alcohol), producing effects

on mood and feeling states, acting as a reinforcer for animals, leading to drug-seeking behavior with deprivation, and showing similar patterns of persistence in the face of evidence that it is highly damaging to health (Fagerstrom, 1991). As with other addicting substances, individual variability in the intensity of the dependence is wide, and although a large number of smokers successfully quit on their own, many others can benefit from a variety of available interventions ranging from self-help to brief counseling to intensive treatment.

Following is a description of an approach to determining readiness for quitting, current treatment strategies available to the smoker and clinician for assisting the smoker to stop, and special problem areas in smoking treatment that need to be addressed. The approaches are based on the evidence-based Agency for Healthcare Research and Quality (AHRQ) *Treating Tobacco Use and Dependence* guideline (Fiore et al., 2000) and the "American Psychiatric Association Practice Guideline for the Treatment of Patients With Nicotine Dependence" (Hughes, Fiester, Goldstein, Resnick, Rock, & Ziedonis, 1996). Also discussed is the nicotine-dependent patient who presents with special clinical problems, such as the patient with alcoholism or serious psychiatric problems, in particular depression.

### ASSESSING MOTIVATION AND READINESS TO QUIT

Nicotine dependence is a chronic, relapsing disorder, often requiring five to seven attempts before maintained abstinence is achieved. Stopping smoking is therefore a long-term process of change that takes place in stages over time. Individuals typically proceed through the following stages of change: (1) precontemplation, (2) contemplation, (3) preparation, (4) action, and (5) maintenance (DiClemente et al., 1991). Different stages of change require different degrees of help and interventions on the part of the clinician.

Approximately 40% of smokers are not thinking about stopping smoking and are said to be in the *precontemplation* stage of change (Velicer et al., 1995). These smokers may be unaware of the risks of smoking, unwilling to consider making a change, or discouraged regarding their ability to quit. Many psychiatric patients fall into this stage of change. For the precontemplator, the clinician's goal is to raise doubt in the person's mind about whether he or she

wants to continue smoking by increasing the patient's perception of the risks and problems associated with his or her current behavior and the potential benefits of quitting. Another 40% of smokers express ambivalence regarding stopping smoking. These smokers are in the *contemplation* stage of change. They report thinking about quitting and seek information about smoking and stopping, but are not ready to commit to quit and express uncertainty regarding their desire or ability to stop.

The final 20% of current smokers are ready to stop smoking in the next month and are in the *preparation* stage of change. Many of these individuals have made a serious quit attempt in the past year or have taken steps toward stopping, such as telling others of their intent to quit, cutting down on the number of cigarettes smoked, or imagining themselves as nonsmokers. The clinician's goal with the smoker in the preparation stage is to help the individual determine the best course of action to take and develop the strategies and skills needed to make a successful quit attempt. Individuals in the *action* and *maintenance* stages of change are no longer smoking. Particularly in the action stage they are at risk for relapse and the best approach with them is to work on relapse prevention.

## MODES OF INTERVENTION DELIVERY

Smoking interventions can be delivered through a variety of modalities, as reflected in the *Best Practices for Comprehensive Tobacco Control Programs* document produced by the CDC (1999). The CDC recommends identification, advice, and provision of brief counseling to smokers within the course of routine care, as well as making available to the smoker a full range of self-help materials, cessation aids, and services including pharmacological aids, behavioral counseling (group and individual), and follow-up visits. Since only a small minority of even motivated smokers will attend intensive treatment programs, self-help interventions have increased in popularity over the past several years. Self-help includes the use of booklets and manuals, audiotapes, videos, Internet, or hotlines or seeking the help of friends, colleagues, or family.

The value of brief counseling has been demonstrated, particularly when accompanied by the use of pharmacological aids such as nicotine replacement therapy (NRT) or bupropion, and when some type of follow-up occurs, either in person or by telephone

(Fiore et al., 2000). Clinicians conducting brief counseling can supplement their intervention with a wide range of self-help materials and audiotapes now available. A stepped-care approach can be used in which, for example, less dependent smokers or smokers who are ready for action may benefit from brief counseling while a more dependent smoker or one who needs more intensive help can be referred to a smoking treatment specialist or a treatment group.

Intensive treatment programs are available mostly in outpatient settings, through telephone counseling, and through the few inpatient treatment programs that exist. For more intensive individual or group treatment, weekly contact for approximately 4 weeks and then biweekly contact for another 4 weeks is a reasonable frequency and one that provides the tapering of contact necessary for the patient to internalize control. For the more dependent smoker or one who has other psychiatric problems, a longer and more intensive intervention may be necessary.

Smokers who are ready to make a quit attempt can be helped by clinicians who provide assistance ranging from very brief (5 minutes) to very intensive interventions. At any intensity, developing a quit plan and arranging follow-up to support the individual through the quitting process are recommended. In an individual treatment plan, the physiological, psychological, and social aspects of the patient's dependence need to be taken into consideration. The treatment plan should include the evidence-based strategies identified by the AHRQ clinical practice guideline (Fiore et al., 2000) and summarized in Table 1.

## Professional Treatment

### *Addressing Physiological Dependence*

Nicotine replacement therapy and bupropion are effective treatments for nicotine dependence and can be used by smokers who are interested in quitting, unless contraindicated. The Fagerstrom Test for Nicotine Dependence (FTND) is an excellent tool for assessing level of dependence. If a smoker reports having had significant withdrawal symptoms during prior quit attempts, has a pattern of relapsing within a few hours or days, and scores high on the FTND, nicotine dependence probably plays an important role in maintaining his or her smoking behavior. For all smokers, and especially highly dependent persons, nicotine fading, nicotine replacement therapy, or nonnicotine medication (bupropion) could be used.

**Table 1** Strategies for Assisting Smokers Who Are Ready to Quit

Action	Strategies for Implementation
1. Help the patient develop a quit plan	<i>Set a quit date</i> , preferably within the next week. <i>Tell</i> family, friends, and coworkers of intent to quit and request understanding and support. <i>Anticipate challenges</i> to planned quit attempt, particularly during the critical first few weeks, including nicotine withdrawal symptoms, and prepare to address them. <i>Remove</i> cigarettes from environment.
2. Provide practical counseling (problem solving/skills training)	<i>Abstinence</i> : Total abstinence is essential. "Not even a single puff after the quit date." <i>Past quit experience</i> : Review to identify high-risk situations and what helped and hurt. <i>Anticipate triggers or challenges</i> : Discuss challenges/triggers and how patient will successfully address them. <i>Alcohol</i> : Consider limiting or abstaining from alcohol during the quitting process as alcohol is highly associated with relapse. <i>Other smokers in the household</i> : Encourage patient to quit with housemates or ask that they not smoke in their presence.
3. Provide intratreatment social support	Provide a <i>supportive clinical environment</i> while encouraging the patient in his or her quit attempt, clearly stating the clinic staff's availability to assist the patient.
4. Help patient obtain extratreatment social support	Encourage the patient to <i>ask spouse/partner, friends, and coworkers to support</i> his or her quit attempt.
5. Recommend the use of pharmacotherapy, unless contraindicated	Recommend the use of <i>nicotine replacement therapy or nonnicotine pill, bupropion</i> (see section on pharmacotherapy).
6. Provide supplementary materials	Provide patient with <i>self-help materials</i> appropriate to his or her age, culture, race, and educational level.
7. Schedule follow-up contact, either in person or via telephone	<i>Follow-up</i> should occur within the first week after the quit date. <i>If abstinent at follow-up</i> , congratulate success, address problems encountered and challenges anticipated, and monitor pharmacological aids used. <i>If smoking occurred</i> , review circumstances leading to smoking, elicit recommitment to total abstinence, address problems encountered and challenges anticipated, review pharmacological aid use and problems, and consider referral to more intensive, specialized treatment.

SOURCE: Adapted from Fiore et al. (2000). This document is in the public domain and may be used without special permission.

*Nicotine Fading*

Nicotine fading (Foxx & Brown, 1979) has two components: brand switching to a lower-nicotine-level cigarette and gradual reduction of number of cigarettes smoked. Switching to brands with lower nicotine levels one or more times over several weeks, in combination with reducing the number of cigarettes smoked by about one half per week, can reduce withdrawal symptoms in the person who smokes heavily. However, the evidence does not support brand switching alone. In fact, if smokers use compensation techniques

such as vent blocking, puffing more frequently, or inhaling more deeply when smoking lower-nicotine cigarettes, their nicotine yield will be considerably higher than that suggested by the Federal Trade Commission ratings. Smokers should be cautioned about this possibility and advised to keep such compensation behaviors to a minimum during the nicotine fading process. On the other hand, unlike the myth that a smoker needs to quit "cold turkey," there does not appear to be a significant difference in cessation rates between quitting cold turkey compared to gradually reducing the number of cigarettes smoked

(Fiore et al., 2000): therefore, patient preference should determine the approach selected. If nicotine fading is used, it should be combined with behavioral management strategies such that “lower need” cigarettes are eliminated first and awareness of the function of each cigarette is increased.

### *Pharmacotherapy*

Five pharmacological aids have been approved by the Food and Drug Administration for use in the treatment of nicotine dependence. These pharmacotherapies fall into two general categories: nicotine replacement therapies and a nonnicotine pill (bupropion). It is important to emphasize to smokers that pharmacotherapies are not “magic bullets.” Rather, they are used to help minimize or dampen withdrawal symptoms while smokers work to break the conditioned connections between smoking and the activities and emotions of their daily lives, and to develop coping skills to replace the many functions of smoking. Table 2 provides a summary of all five pharmacological aids currently recommended as first-line medications.

The purpose of the four nicotine replacement therapies is to prevent or minimize the symptoms of withdrawal or cravings by replacing some of the nicotine that would otherwise be obtained from smoking. This allows the individual to focus on the behavioral and emotional aspects of stopping smoking. All four forms of nicotine replacement therapy have been found to be equally efficacious, approximately doubling quit rates compared to placebo. In most studies, concomitant supportive or behavior therapy has produced substantially higher quit rates than either behavior therapy or nicotine replacement alone.

Bupropion HCl SR is an atypical antidepressant believed to work on the neurochemistry of addiction by enhancing dopamine levels and affecting the action of norepinephrine in the brain, both neurotransmitters believed to be involved in nicotine dependence (Ascher et al., 1995). As with the nicotine replacement therapies, bupropion has been found to consistently double quit rates compared to placebo.

### **Addressing Psychological Dependence: Cognitive and Behavioral Interventions**

Cognitive and behavioral interventions for smoking have been developed from cognitive and behavioral treatment techniques used to treat a wide range

of behavioral and addictive disorders and have been found to typically double quit rates compared to control groups (Fiore et al., 2000). The cognitive-behavioral approach intertwines assessment and intervention. First, past quit attempts are reviewed to identify the reasons why the quit attempts were made, what methods the smoker used (e.g., cold turkey, tapering, pharmacological aids), problems experienced (including withdrawal symptoms), strategies that helped, and what led to relapse. The key is to assist the patient in reframing past efforts to stop smoking as learning experiences and to apply what was learned to the current quit attempt. Second, current smoking patterns are assessed. In what situations and in response to what feelings or emotions does the patient most feel like smoking? These are “high need” cigarettes. Asking the smoker to rate the level of need for each cigarette smoked on a scale of 1 (*low need*) to 5 (*high need*) is often helpful. Once anticipated problems and triggers are identified through review of past quit attempts and assessment of current smoking patterns, the patient can be helped to develop specific cognitive-behavioral coping strategies to address these problems and triggers.

### **Preventing Relapse and Maintaining Change**

A major difficulty in smoking cessation, as with other substance abuse behaviors, is maintenance of the changed behavior. As many as 70% of those who stop smoking relapse within a year, with the strongest predictor of relapse being a slip within a relatively brief period of time (average between 18 and 60 days of cessation) (Ockene et al., 2000). Up to 65% of persons who quit smoking on their own relapse within the first week after cessation (Hughes & Hatsukami, 1992). Relapse prevention includes being aware of any slip that occurs, that is, taking a puff or more of a cigarette, and catching it before it becomes a relapse. Intensive relapse prevention interventions should be delivered when an individual experiences problems in maintaining abstinence, tailored to the specific problems encountered.

### **SPECIAL PROBLEM AREAS**

#### **Smoking Cessation and Weight Gain**

Although the average weight gain for sustained quitters of 5-6 kilograms (Froom, Melamed, & Benbasal, 1998) does not present a medical risk equal

**Table 2** First-Line Medications for Treating Nicotine Dependence

<i>Product</i>	<i>Nicotine Patches<sup>1</sup></i>	<i>Nicotine Gum<sup>1</sup></i>	<i>Nicotine Inhaler</i>	<i>Nicotine Spray</i>	<i>Bupropion SR</i>
<b>Brand names</b>	Nicotrol CQ Nicoderm Generic (various store brands)	Nicorette Generic (various store brands)	<b><i>Nicotrol Inhaler</i></b>	<b><i>Nicotrol NS</i></b>	<b><i>Zyban, Wellbutrin<sup>2</sup></i></b>
<b>Product strengths</b>	7 mg, 14 mg, 21 mg per patch (for typical systems that deliver 17, 32, 52 mg per day of nicotine)	2 mg (for avg smokers <= 24 cigs/day) 4 mg (for heavy smokers > 24 cigs/day)	10 mg/cartridge	10 mg/ml	150 mg
<b>Amount of nicotine delivered<sup>3</sup></b>	<i>16-hr patch:</i> 15 mg/day <i>24-hr patch:</i> 7 mg/day, 14 mg/day, 21 mg/day	Up to 0.8 mg per 2-mg piece Up to 1.5 mg per 4-mg piece	Up to 2 mg per cartridge	0.5 mg 2 sprays	N/A
<b>Special directions for use</b>	Apply to nonhairy part of body	Alternately chew and park for 20 minutes; nicotine absorbed through oral mucosa when gum is parked; avoid acidic beverages	Take frequent puffs over 20 minutes; nicotine absorbed through oral mucosa; avoid acidic beverages	Two sprays in each nostril	None
<b>Dosing intervals and maximum doses</b>	<i>16-hr patch:</i> 16 hrs on; 8 hrs off <i>24-hr patch:</i> Replace every 24 hrs (option to remove at bedtime)	1 piece every 1 to 2 hours and as needed for craving Maximum: 24 pieces per day	Multiple puffs on a cartridge every 1-2 hours or as needed 6-16 cartridges per day Maximum: 16 cartridges per day	1-2 doses/hr (1 dose = 2 sprays or 1 per nostril)	150 mg/day (days 1-3) 150/twice per day (after day 3)
<b>Time to peak plasma level</b>	5-10 hrs	20-30 mins	15 mins	5-7 mins	3 hrs
<b>Manufacturer's recommended tx duration<sup>4</sup></b>	<i>16-mg patch:</i> 6 weeks <i>24-hr patch:</i> Initial: 21 mg for 4 weeks; taper: 14 mg and 7 mg for 2 weeks each	Initial: 6 weeks Taper: 6 weeks	Initial: Up to 12 weeks Taper: 12 weeks	Initial: Up to 8 weeks Taper: 4-6 weeks	7-12 weeks Maintenance: Up to 6 months
<b>Adverse reactions</b> (treatment of reaction)	50% experience mild irritant skin reactions (rotate and use steroid cream, rare allergic skin reaction; vivid dreams, sleep disturbances while on the patch 24 hrs (remove at bedtime)	Mouth soreness, hiccups, dyspepsia, and jaw ache (usually mild and transient; correct technique)	40% experience mouth and throat irritation (may resolve with regular use); dyspepsia	Local transient irritation in the nose and throat, watery eyes, sneezing and cough	Dry mouth; insomnia (avoid bedtime dose); shakiness

(Continued)

**Table 2** (Continued)

<b>Absolute contraindications</b>	Previous hypersensitivity reaction to any of the products (i.e., serious allergic reaction) Heart attack within 6 weeks or unstable angina Heart attack within 6 weeks; unstable angina; serious heart arrhythmia; uncontrolled hypertension; active peptic ulcer disease for all NRT				
	Severe eczema or other skin diseases that may be exacerbated by the patch	Severe TMJ disease or other jaw problems; dentures	Allergy to menthol	Active rhinitis; active sinusitis	History of seizure; current or prior dx of bulimia or anorexia nervosa; concurrent or recent use of MAO inhibitors
<b>Relative contraindications/precautions</b>	Moderate or severe hepatic or renal impairment for all products Active hyperthyroidism; peripheral vascular disease for all NRT				
	Hot work environment (reduced patch adhesion); mild-moderate skin disease	Any jaw problem that affects gum chewing; dental appliances affected by gum	Oral or pharyngeal inflammation	Asthma; nasal polyps	Agitation; anxiety, insomnia; history of head trauma or other risk factor for seizure
<b>Pregnancy category<sup>5</sup></b>	D	C	D	D	B

1. Available without prescription
2. Zyban is brand name for bupropion SR marketed for smoking cessation with support materials; Wellbutrin is brand name for bupropion SR marketed for depression.
3. Typical cigarette delivers 1-3 mg of nicotine.
4. Manufacturer recommendations based on duration of treatment in initial clinical trials. Many independent trials of NRT suggest treatment for 8 weeks is as effective as longer treatments for most, but shorter and longer intervals are reasonable depending on individual smoker.
5. Pregnancy categories:
 

B: *No evidence of risk in humans.* Adequate, well-controlled studies in pregnant women have not shown increased risk of fetal abnormalities despite adverse findings in animals, or, in the absence of adequate human studies, animal studies show no fetal risk. The chance of fetal harm is remote, but remains a possibility.

C: *Risk cannot be ruled out.* Adequate, well-controlled human studies are lacking, and animal studies have shown a risk to the fetus or are lacking as well. There is a chance of fetal harm if the drug is administered during pregnancy; but the potential benefits may outweigh the potential risks.

D: *Positive evidence of risk.* Studies in humans, or investigational or postmarketing data, have demonstrated fetal risk. Nevertheless, potential benefits from the use of the drug may outweigh the potential risk. For example, the drug may be acceptable if needed in a life-threatening situation or serious disease for which safer drugs cannot be used or are ineffective.

to smoking a pack of cigarettes a day, weight gain is an issue that is important to many people and provides a common reason for starting, continuing, and returning to smoking. Several factors have been implicated in weight gain, including an increase in metabolism from nicotine intake (Perkins, 1992), which may cause increased weight while quitting even without increased caloric intake and change in preference for sweets while smoking. These biological factors, in combination with the use of food as a behavioral substitute, make it important to address weight gain explicitly in most treatment programs. However, to date there has been no published empirically tested treatment that successfully addresses weight gain while quitting. Dieting while quitting increases the rate of relapse (Ockene et al., 2000).

### Smoking Cessation and Alcohol

Tobacco use and alcohol abuse are moderately to strongly related (Istvan & Matarazzo, 1984). Among identified alcoholic persons, the incidence of smoking has been 80% to 90% in all studies; alcoholic persons also are more likely to smoke heavily (Bien & Burge, 1990; Bobo, 1989). Consequently, most patients seen in an alcohol treatment program will be smokers, many of them at a level that is acutely health endangering, thereby underscoring the need to treat nicotine dependence in this patient population.

Data obtained from individuals in substance abuse treatment suggests that it is difficult to quit smoking while undergoing substance abuse treatment but that working on smoking cessation does not increase relapse to alcohol use (Kalman, 1998). In fact, it has been found that in some instances smoking cessation is associated with a decreased relapse back to alcohol use. The American Psychiatric Association practice guidelines for the treatment of patients with nicotine dependence (Hughes et al., 1996) recommends that the timing of smoking cessation in relationship to alcohol abuse treatment should be determined by the patient.

### Smoking Cessation and Psychiatric Disorders

Increasing attention is being paid to the role of smoking in psychiatric disorders in regard both to the role of the CNS effects of nicotine and to the apparent special value of smoking to psychiatric patients (Glassman, 1993). Several studies show a much higher prevalence of smoking in psychiatric populations

(i.e., 50-90%), particularly in those with depression (Covey, Glassman, & Stetner, 1998) and schizophrenia (Glassman, 1993). The evidence is less clear regarding the increased prevalence in those with anxiety disorders. Some psychiatric patients may be actively self-medicating through their use of cigarettes.

Although research is beginning to document the effects of smoking in psychiatric populations, little empirical evidence is available regarding the treatment of nicotine dependence in such patients. In the psychiatric patient for whom smoking cessation is critical for medical reasons, a comprehensive intervention plan is indicated including the treatment components outlined earlier in this entry. In particular, behavior therapy focused on the development of coping and social skills is important and adjustment of medication may be needed, either in an attempt to decrease continued dependence on self-medicating with nicotine or in response to possible interaction effects.

### SUMMARY

Clear, evidence-based clinical practice guidelines are available to assist the clinician in treating nicotine dependence. As a chronic, relapsing disorder, stopping smoking requires a long-term process of change. The assessment of an individual's motivation or readiness to quit allows the clinician to tailor intervention accordingly. It is recommended that brief counseling be provided to all smokers within the context of routine care and that a full range of cessation aides and services be made available. These include self-help materials, pharmacological aids, group and individual cognitive and behavioral counseling, and follow-up. Special attention should be given to smokers who present with concerns regarding weight gain and those with alcohol and psychiatric disorders.

—Judith K. Ockene and Lori Pbert

See also HEART DISEASE AND SMOKING; SMOKING AND HEALTH; SMOKING AND NICOTINE DEPENDENCE; SMOKING PREVENTION AND TOBACCO CONTROL AMONG YOUTH

### Further Reading

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## SMOKING PREVENTION AND TOBACCO CONTROL AMONG YOUTH

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The prevention of cigarette smoking and other forms of tobacco use is among the world's leading public health priorities. Tobacco use continues to be the leading preventable cause of death in the United States. Smoking and spit tobacco use begins early in life; currently, about one third of high school-age adolescents in the United States use tobacco. Adolescence is the critical time period for prevention and early cessation efforts, given both the highly addictive nature of the substance and that the vast majority of smokers begin smoking before the age of 18. If interventions can keep youth tobacco free through adolescence, the chances of their initiating smoking after high school are much smaller.

Numerous studies have also found that adolescents who smoke are more likely to use other drugs. The

social, psychological, and biological factors that contribute to an individual's use of tobacco are similar to the factors that contribute to the use of other drugs. Cigarette smoking is also correlated with other high-risk behaviors, such as violence and unprotected sex. These added risks underscore the need for effective smoking prevention programs, as it may be possible to delay or prevent the other behaviors by preventing tobacco use.

The need for effective tobacco prevention in youth derives from some important health consequences of adolescent tobacco use. Cigarette smoking during adolescence appears to reduce the rate of lung growth and inhibits full lung function. Adolescents who smoke are more likely to be less physically fit than nonsmokers and are more likely to experience shortness of breath and other respiratory problems. Smoking during adolescence also sets the stage for threats to adult health, as health problems associated with smoking are a function of duration and amount of use. If smoking begins during adolescence, the duration of the habit is longer and long-term health outcomes are more serious. Smoking during adolescence leads to an increased risk of early atherosclerotic lesions. Spit tobacco use directly contributes to periodontal disease and can cause oral cancer even among youth. Overall, tobacco use during adolescence has a deleterious health impact on young people, accelerating as they develop and grow into adults.

## INFLUENCES

For the development of effective interventions, it is necessary to examine environmental, psychological, and behavioral variables that affect adolescent tobacco use. Such variables may be relatively distal or proximal to actual smoking behavior. Distal factors do not always have a direct or immediate impact on smoking, nor is their causal pathway necessarily well known. Proximal influences in contrast may demonstrate an immediate and obvious influence, but in turn may be caused by or mediate the impact of the distal factors. Influences must be examined not only in terms of regular smoking outcomes but also in the context of movement along a continuum of smoking uptake, from not considering smoking, to not smoking but being susceptible to the possibility of being offered a cigarette in the future, to less and then more frequent experimentation, and finally, to regular smoking.

Socioeconomic status, for example, comprises an important distal predictor of adolescent substance use. Children from single-parent homes or poor families are more likely to initiate smoking during adolescence. Mass media may also be influential in adolescent tobacco use. Cigarette advertising appears to have an indirect effect on legitimizing tobacco use, while concurrently directly affecting adolescents' perceptions of smoking prevalence, the esteem in which smoking is held, and attitudes about the function of smoking. Since these cognitive factors represent psychosocial risks for smoking, advertising may have a direct impact on the initiation of tobacco use.

Yet more proximal to the uptake of smoking are physical and social environmental factors such as the availability of cigarettes and peer influence to smoke. If someone in the household smokes, adolescents have cigarettes easily available to them. It has also been found that if a youth's friends smoke, he or she is more likely to smoke as well, a product of both peer pressure and availability factors. Peer groups influence expectations, reinforce smoking behavior, provide cues for experimentation, and provide the actual cigarettes.

Other proximal intrapersonal risk factors associated with tobacco use include low self-image, low self-esteem, lack of self-confidence, and insufficient knowledge about tobacco use. These factors contribute to an inability to say no to peers. A lack of self-confidence may represent a reflection of low self-esteem and low self-image. If adolescents do not feel that they have the ability to refuse a cigarette and still be liked by their peers, they are more likely to succumb to peer pressure to smoke. Insufficient knowledge about tobacco use also contributes to initiation. If one is not aware that smoking is harmful or has incorrect knowledge about its addictive capabilities, that person is more likely to accept a cigarette. If subjective norms lead adolescents to believe that there are more people smoking than is actually the case, they will be more likely to initiate smoking. Subjective norm effects hold true for availability as well: Those who perceive that cigarettes are easily obtained are more likely to begin using tobacco than those who perceive more difficulty in obtaining cigarettes. Therefore, the salient influences to smoke may derive not only from the actual environment but also from the adolescent's perception of that environment.

Behavioral risk factors associated with adolescent tobacco use include general risk-related behaviors, such as poor academic achievement and low school

involvement. Individuals with poor grades and low school involvement are more likely to have low self-esteem and feelings of self-worth, which, in turn, make them more vulnerable to tobacco and other substance use.

Immediately proximal to the onset of tobacco use are interpersonal skill deficits, specifically, a lack of ability to refuse the offer of a cigarette or other substance from a peer in a socially adept manner. Most risk factors for initiation of smoking are interrelated with each other. Therefore, it is a combination of these factors that must be taken into account when designing interventions to properly address the process of smoking initiation.

Exposure to environmental tobacco smoke (ETS) not only may influence youth to smoke but at the same time comprises a direct threat to their health as well as that of all others who are exposed. The Environmental Protection Agency (EPA) has concluded that exposure to tobacco smoke causes lung cancer as well as coronary heart disease, causes serious respiratory problems in children, and can lead to death. Secondhand smoke has also been classified as a Group A carcinogen by the EPA. Thus, the importance of policies that are geared at decreasing ETS cannot be underestimated.

The tobacco industry from its inception has been quick to take advantage of the power of media and advertising. Given the association between cigarette advertising and smoking among youth, antitobacco efforts have also been quick to act and create policies that have severely restricted the industry's ability to advertise through certain means of communication. For example, the universally recognized "Marlboro Man" cowboy saw his last appearance on television in 1971, when all tobacco commercials were banned from American television. The 1980s saw the birth of Joe Camel, a cartoon character designed to promote Camel cigarettes. Although Joe Camel was forced from the scene, the tobacco industry continues to find other avenues through which it can effectively continue to target youth such as through brand placement and the depiction of cigarette smoking in movies.

## INTERVENTIONS

In a literature review, Lantz and her colleagues categorize current smoking prevention and control strategies as applied to youth tobacco consumption. These categories (many of which relate to adult consumption and prevalence as well) include (1) school-based

educational interventions (or classroom-like programs offered in the community), (2) school policies, (3) community interventions, (4) mass media and anti-tobacco advertising campaigns, (5) tobacco advertising and marketing restrictions, (6) restrictions regarding youth access to tobacco and on the sale of tobacco products, (7) tobacco excise taxes, (8) restrictions on smoking and penalties for possession and use, (9) vendor penalties, and (10) interventions with high-risk youth and early-cessation programs.

### School-Based Educational Interventions

School-based educational interventions traditionally focus on cognitive and affective responses among youth, in attempts to influence knowledge, beliefs, attitudes, intentions, and subjective norms related to smoking. In general, these approaches appear to be ineffective when not accompanied by direct behavior change efforts. A second typical educational intervention evolved more recently, emphasizing peer pressure resistance or "social inoculation." Brief interventions center around social inoculation activities, which through role-plays teach refusal skills for resisting prompts to smoke. These role-plays are placed in the context of realistic mock situations, in which peers or others play the part of the friend, sibling, or adult trying to convince the participant to try a cigarette. Social inoculation programs have been shown to be at least somewhat effective in reducing smoking onset.

Teachers, older youth (including college students), or same-age peers typically lead school-based interventions. Peer-led interventions have often been touted as being more effective than teacher-led interventions; however, training and deploying same-age peers can present significant logistical problems. Therefore, older high school or even college students may be recruited to perform the function of the peer leader, as they have sufficient maturity to accept this responsibility but at the same time are still sufficiently young to be able to relate to students typically of middle school age.

Current school-based programs typically involve most or all of the following components: behavioral skills (especially refusal skills) development, behavioral contracting, media pressure and health education, social influences and normative education, peer interaction and instruction, the development of self-confidence and self-esteem, stress management, community involvement, and cessation tips for those

already smoking. A typical sixth-grade curriculum will include lessons on health effects, values clarification, decision making, health consequences, behavioral alternatives, refusal skills, and encouraging adults to quit. In seventh grade, this would evolve to norm perceptions and false perceptions, dangerous industry and retail practices, equating cigarettes to smokeless tobacco, the role of peer pressure and how to deal with it, making choices, saying no without being left out, and extensive role-plays. Eighth-grade classes might emphasize cessation, social activism, and reaching out to younger relatives and friends to keep them away from cigarettes. Lessons are augmented by handouts and videos that complement and extend the information presented by the peer leaders or teachers.

Multiple-year school-based interventions, extending throughout the middle school years and even into high school (and thereby capturing the adolescent at different developmental stages), may be more effective than single-year interventions. These longer interventions allow for multiple themes to be addressed (e.g., social inoculation, media, politics, and the tobacco industry), and adjust for developmental change in the target population as they move through these years of higher risk.

### **School Policies and Penalties for Possession and Use**

Educational efforts alone are probably insufficient to realize an adequate prevention effect. Fairly recently, a variety of communities and states have initiated efforts to place penalties on the books for underage individuals carrying or using tobacco products in school or generally in public. Typically, youth are ticketed or fined for possession or use. Relatedly, strong school policies that proscribe smoking, in place with smoking prevention efforts, may prove effective in lowering schoolwide prevalence.

### **Community Interventions**

Schools are not established primarily for the purposes of health promotion and substance use prevention. In fact, pressures to improve standardized test scores, provide extracurricular activities, and at the same time offer an extensive and varied curriculum make schools increasingly reluctant to designate classroom time for tobacco education. Some community

programs have circumvented this barrier by either conducting programs with community-based groups of youth (e.g., YMCA/YWCA, religious groups, Scouts) or delivering prevention interventions through brief phone calls to students. In the latter scenario, students are introduced to the project in the school and then told they will receive several smoking prevention newsletters and be contacted by a peer counselor. This older youth calls periodically following the mailing of the newsletter with information such as that presented above, such as encouraging the younger student to make a commitment not to smoke, and problem solving any difficult social pressures that are being encountered. Calls are typically made during latchkey hours (i.e., unsupervised periods at home, typically before parents arrive home from work), which are times of a higher probability of smoking and other high-risk behaviors.

Community interventions have many parallels with school-based interventions, but more typically involve families, school administration, churches, businesses, media, social service and health agencies, government, and law enforcement. These approaches assume a broader, ecological view of the smoking onset problem and how to confront it. The community environment may influence smoking or its prevention through the availability of cigarettes and spit tobacco, laws and social norms, and media and societal messages (e.g., thetruth.com antitobacco messages via the Internet; and conversely, tobacco product placement and the depiction of smoking in movies). Community-based interventions offer the prospect of reaching a larger audience, complemented by school-based and other tobacco control programs that increase the frequency with which the nonsmoking message is received by the target audience. Students participating in school programs may actually be encouraged to write letters to local newspapers, elected officials, and retailers, and in other ways demonstrate their antitobacco attitudes to the community. School-based or classroom-like programs and community interventions may have a synergistic effect in communities, which benefit from both of them.

### **Tobacco Advertising Restrictions**

As the tobacco industry continues to strategize about how to promote its product to youth, it is necessary that public health professionals ensure that policies are being constantly created to counteract each

and every new move. For example, the Joe Camel campaign caused such an uproar that its usage was eventually banned, as this cartoon character was seen to be deliberately created to target youth. In California, R.J. Reynolds Tobacco Company was fined for specifically targeting kids in magazines, and was also specifically ordered to stop marketing to youth.

As researchers have demonstrated the effectiveness of tobacco advertising in increasing youth curiosity about and attraction to using tobacco products, calls to restrict or ban advertising have increased. However, bans may not achieve the intended effectiveness, because cigarettes can still be promoted via placement in movies, at sporting events, and in other formats and venues popular among youth. Recently, the European Union realized a very important step in the fight against tobacco by banning advertisements in magazines, in newspapers, on the radio, and via the Internet. Tobacco companies are also prohibited from sponsoring events like Formula One motor racing. Recommended but not required are bans on billboard advertisements and the use of brands and logos on clothing and other consumer materials. Barring court challenges, member countries are to enact these regulations no later than January 2005.

### Mass Media Campaigns

A variety of studies have shown mass media campaigns to be effective in decreasing tobacco use onset and increasing antitobacco attitudes. This has especially been shown to be the case if such efforts are accompanied by other potentially powerful interventions such as taxation or school interventions. Media messages that advocate social change in which youth are exhorted to be aware of the manipulation that the tobacco industry is trying to realize in promoting smoking to them may be especially attractive to youth.

Recent advertising campaigns have been deployed to counter tobacco advertising and to increase the attention to and attractiveness of the nonsmoking/anti-tobacco spots. These campaigns may comprise important complements to the overall tobacco control effort (e.g., increasing excise taxes, developing and enforcing sales policies).

“The Truth” exemplifies recent effective media campaigns targeting youth smoking. The Truth has framed the issue of youth smoking not by telling young people not to smoke, but rather by informing them about general tobacco-related issues and helping

them make their own decisions. The Truth claims that their goal is not to end smoking, but rather to tell the “truth about how it really is.” One of its main objectives is to inform young people about the hidden practices of the tobacco industry, how cigarettes and spit tobacco get marketed, the nature of addiction, and tobacco’s impact on health. Launched in 1999 by the American Legacy Foundation, The Truth ads now appear in a variety of media, including television, radio, magazines, and the Internet (thetruth.com).

### Stopping the Sale of Tobacco to Youth

The Symar Amendment of 1991 establishes that all states in the United States must enforce laws that restrict the sale of tobacco to youth, and must demonstrate success in reducing youth access. This amendment has led to a variety of complementary interventions to restrict youth access and enforce existing laws, such as sting operations that employ underage confederates to attempt cigarette purchases in targeted convenience stores, gas stations, and other tobacco retail outlets. If “successful” in their effort, these teens inform the sales clerk that he or she is breaking the law by offering to sell the product. When clerks refuse to sell, they and the store managers are reinforced for their compliance. Such efforts apparently are effective in reducing illegal tobacco sales, at least in those stores specifically targeted by sting operations. Complementary media efforts may be required to communicate the program’s purpose to nontargeted stores, such as by providing positive publicity to those stores that complied with the law.

Although restricting youth purchasing of cigarettes is important, it must also be shown that such restrictions actually decrease the amount of youth smoking. Community-wide efforts to limit sources of sales through development of new policies by community officials, and the enforcement of existing policies by working with retailers, can be effective in at least slowing the onset of smoking. Nevertheless, youth still have other avenues for obtaining cigarettes, including through “social sources,” that is, the cigarettes they receive from friends, brothers and sisters, or even parents.

### Cigarette Prices and Tobacco Excise Taxes

Cigarette taxes in many parts of the United States are still quite low compared to many European and

Canadian standards. Although youth who already smoke may continue to spend money on cigarettes regardless of the price, continuing to increase the unit price to them will result in a decrease of consumption and even convince some not to take up the habit in the first place.

The primary method for increasing tobacco product prices is through tobacco excise taxes. Tobacco excise taxes comprise specific state and local government taxes on cigarette products. Until about 15 years ago, such taxes were seldom seen as a method of tobacco control. However, following the 1988 Proposition 99 voter-initiated tax increase in California, through which the excise tax was increased \$0.25 per pack and a sharp reduction in tobacco purchasing was quickly evident, public health officials have increasingly advocated the use of such "sin taxes." Excise taxes may be especially effective if the revenue is dedicated to additional antitobacco education and policy development. The U.S. Surgeon General's office now advocates increased tobacco prices to promote prevention and cessation efforts.

### Smoking Cessation

A sole focus on primary prevention ignores the fact that addiction and health damage may be prevented among the many adolescents who already experiment or regularly smoke. Cessation interventions for adolescents who are already smoking on a daily or otherwise frequent basis have gained increasing attention over the past few years. Smoking cessation rates among motivated adolescents enrolled in formal programs may approach those of adults. The American Lung Association's NOT on Tobacco (NOT) Program provides one example of a promising smoking cessation effort. Specifically for adolescents, NOT includes ten 50-minute sessions offered weekly over consecutive weeks. NOT comprises a "total health approach" to smoking cessation, with a focus on motivation, smoking history, addiction, consequences of smoking, preparing for quitting, preventing relapse, dealing with ongoing social pressure to smoke, and increasing healthy physical activity levels and nutrition change.

Adult smokers who receive regular advice from their physicians to quit smoking will evidence modest but important improvements in their cessation rates over those who do not receive such advice. Recently, experts have begun to argue that adolescents should

receive similar advice for cessation, since many teen smokers, especially daily users, desire to give up the habit. The office environment can support such efforts through chart marking, waiting room literature and signs, and identifying a smoking cessation coordinator. Nurses and other allied health professionals can also complement the advice and follow-up on referrals to make sure that teen smokers get the help that they need to quit. The nicotine patch and other pharmacological adjuncts may be important elements of cessation, although the effectiveness of this approach for teens has yet to be proven. Nevertheless, interventions for teen smokers should be modified depending on how far the habit has progressed, from light experimentation to heavy smoking.

### Direct Restrictions

In addition to restrictions on sale by banning vending machines or exiling them to adult-only venues (e.g., bars), recent efforts have emphasized reduction in self-service displays of tobacco. Some communities have banned billboard advertisement and other forms of marketing tobacco near school grounds. Over the years, the implementation of laws that restrict smoking in certain public places comprise some of the great achievements in the war against tobacco in terms of prevention, cessation, and exposure of nonsmokers. In 1994, the Pro-Children's Act was passed by the federal government to prohibit smoking in all facilities where federally funded children's services are provided. The use of tobacco products is now banned from airplanes, school grounds, some government-owned facilities, and some work places, all of which have reduced the threat of environmental tobacco smoke. "Clean air" laws in many states and communities ban smoking inside a building in which others may be exposed, or at least banish it to a ventilated smoking-break room. Past studies have shown that such indoor smoking bans can be effective in reducing on-site smoking and increasing the smoking cessation rates. Restrictions of smoking in public places may also reduce cigarette smoking among young people.

### FUTURE DIRECTIONS

Prevention efforts remain central to halting the worldwide tobacco pandemic. Lantz and others recommend greater emphasis on the following intervention components:

**Aggressive media campaigns.** Multiple-year efforts to reduce demands for smoking and increase anti-tobacco industry attitudes through hard-hitting media spots designed specifically for youth may be a fairly effective intervention approach, or at least one that complements other effective interventions. Ideally, such campaigns would highlight the connections between the industry and the national, regional, and local political processes that they influence.

**Cessation efforts.** For decades, tobacco control efforts have emphasized prevention for youth rather than cessation, assuming that such cessation efforts were either not recommended because regular smokers were already fairly committed to their habit or conversely that adolescent experimenters could quit easily. Nevertheless, a substantial majority of teens who regularly consume tobacco wish to quit and have not, indicating that a mild to strong addiction has already set in. A strong emphasis, therefore, is needed on helping these teens quit, thereby substantially improving their health and quality of life.

**Changing the environment.** Prevention and cessation efforts, no matter how well meaning, often involve “blaming the victim” activities that put the onus of change on children or youth themselves. By eliminating cigarette advertising, restricting access to tobacco, and communicating an antitobacco attitude through media and cultural messages, environments may become increasingly less conducive to the uptake of the tobacco habit. Limiting access by banning vending machines and making over-the-counter sales less convenient will reduce commercial sources, while media need to be directed to convince adult smokers to eliminate social source availability. The enactment and enforcement of laws to restrict tobacco sales to youth and the continued propagation of clean indoor air statutes will also communicate directly to the youth that society is headed in a non-smoking direction.

**Maintaining an orientation to data.** The public often is unaware of youth tobacco use. Data on local and national prevalence polls, sales to minors, and cigarette versus spit tobacco use; sporting events, movies, and other entertainment media that promote brands and smoking behavior; and even information about what politicians receive funding from the tobacco industry can be used to mobilize public opinion for prevention.

Although prevention efforts have enjoyed some success, teen smoking prevalence remains stubbornly high. In spite of increased restrictions, tobacco products remain highly available to youth. Whatever retail sources of tobacco have been diminished, social sources have seemed to make up for less access from the commercial sector. Clearly, consistent, tenacious, and ever-expanding efforts are required to truly achieve broad-based prevention.

—John P. Elder, Sandra Larios,  
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See also HEALTH PROMOTION AND DISEASE PREVENTION;  
HEART DISEASE AND SMOKING; SMOKING AND HEALTH;  
SMOKING AND NICOTINE DEPENDENCE: INTERVENTIONS

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## SOCIAL CAPITAL AND HEALTH

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The concept of social capital was originally developed in sociology and political science to describe

the resources available to individuals through their membership in community networks. In contrast to financial capital, which resides in people's bank accounts, or human capital, which is embodied in individuals' investment in their education and job training, social capital inheres in the structure and quality of social relationships between individuals. Coleman (1990) identified several forms of social capital, including levels of trust within a social structure, "appropriable" social organizations, norms and sanctions, and information channels. Appropriable social organizations are groups established by individuals to address a particular problem, which can be subsequently appropriated to solve other problems of collective action. For example, a group of residents in a neighborhood might volunteer to establish a community policing association. Besides monitoring and preventing the occurrence of crime in the area, the same association is now potentially available to improve the quality of life of residents in other respects, for example, organizing to prevent the closure of local fire stations, or lobbying municipal authorities to fix broken street lights.

Although the precise definition of social capital is contested and continues to evolve, most versions encompass two dimensions: the structural and the cognitive. The *structural component* of social capital includes the extent and intensity of associational links and activity in society (e.g., as measured by the density of civic associations, measures of informal sociability, and indicators of civic engagement). The *cognitive component* includes people's perceptions of trust, reciprocity, and sharing (Harpham, Grant, & Thomas, 2002). An additional distinction is commonly made between *bonding* and *bridging* social capital. Bonding capital refers to the social connections that exist within a group structure, while bridging capital refers to the social connections that link diverse communities and groups within a society (Putnam, 2000).

## MEASUREMENT OF SOCIAL CAPITAL

Compared to other forms of capital (financial, human), social capital is less tangible, and hence more difficult to measure. Two approaches to measuring social capital include direct social observation, and aggregating responses from social surveys. Because social capital can assume a variety of forms (levels of trust, norms and sanctions, density of civic

associations), the measurement of this construct calls for the use of a variety of approaches.

Direct social observation can include the use of experimental methods, such as the "letter drop experiment," in which stamped, addressed envelopes are deliberately dropped on street corners to determine the proportion of letters that are subsequently picked up by strangers and mailed to the addressee (an experimental indicator of reciprocity). More commonly, empirical studies have resorted to the use of more proxy measures, such as aggregated responses to social survey items inquiring about the extent of interpersonal trust between citizens (e.g., percentage of respondents in a community who agree that "most people can be trusted"), or the density of membership in a range of civic associations including church groups, sports groups, hobby groups, fraternal organizations, labor unions, and so on.

There is some debate over the extent to which the concept of social capital represents "old wine in new bottles." For instance, community psychologists have an established tradition of working with concepts such as "sense of community," "community competence," and "neighboring," all of which appear to tap into aspects of social capital (Lochner, Kawachi, & Kennedy, 1999). Moreover, an extensive literature in health psychology and social epidemiology has dealt with apparently related constructs such as social networks, social support, and social integration. One important distinction that can be drawn between the concepts of social capital, on the one hand, and social networks/social support, on the other hand, is that the former is often explicitly conceptualized and measured at the group level. In other words, social capital is considered a property of the collective (neighborhood, region, state).

A crucial question is whether aggregated responses to survey items (e.g., concerning trust between neighborhood residents) genuinely represent a contextual influence, or whether they are confounded by the demographic, social, and economic attributes of individual respondents that systematically correlate with their perceptions of social capital. Evidence suggests that aggregated survey responses can indeed capture genuine contextual differences. A multilevel analysis of the Community Survey of the Project on Human Development in Chicago Neighborhoods found that even after controlling for demographic (age, sex, race, marital status) and socioeconomic (income, educational attainment) factors at the individual level,



significant neighborhood differences remained in perceptions of trust, substantiating the notion of social capital as a true contextual construct (Subramanian, Lochner, & Kawachi, 2003).

## SOCIAL CAPITAL AND POPULATION HEALTH

Social capital has been linked to economic development, the smooth functioning of democracies, and the prevention of crime, among other benefits (Putnam, 2000). More recently, the notion of social capital has been extended to the population health field to explain variations in the health achievement of societies.

Indicators of social capital are not routinely available on administrative data sets (such as the government census), hence researchers have resorted to the use of secondary sources to tap indicators of social capital, such as the density of membership in civic associations from social surveys, and national opinion poll data on interpersonal trust and perceptions of reciprocity between citizens.

Following the example of the political scientist Robert Putnam (2000), U.S. researchers have analyzed state-level data on interpersonal trust, norms of reciprocity, and membership in voluntary associations from the National Opinion Research Center's General Social Surveys. When correlated with state-level health indicators, these social capital variables explained a significant proportion of the cross-sectional variations in mortality rates across states of the United States (Kawachi, Kennedy, & Prothrow-Stith, 1997). For instance, the level of mistrust (the proportion of residents in a state who agreed that "most people would take advantage of you") was shown to be strikingly correlated with average age-adjusted mortality rates ( $r = 0.79$ ,  $p < .001$ ). Lower levels of trust were associated with higher rates of most major causes of death, including heart disease, cancers, infant mortality, and violent deaths, including homicide. A one standard deviation increase in trust was associated with about a 9% lower level of overall mortality. Similar associations were found between death rates and other indicators of social capital, including norms of reciprocity (the proportion of residents agreeing that "most of the time, people try to be helpful"), as well as per capita membership in a variety of civic associations. The association of social capital indicators with mortality remained after accounting for state differences in median income and poverty rates.

Social capital is associated with not only mortality rates but more general indicators of health status as

well. Using data from 167,259 respondents in the Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS), a strong correlation was found between mistrust and the proportion of residents in each state who rated their own health as being only "fair or poor," as opposed to "excellent, very good, or good" ( $r = 0.71$ ,  $p < .0001$ ) (Kawachi, Kennedy, & Glass, 1999). These associations persisted after control for individual-level factors that could account for poor health status. After taking account of individual-level differences in variables such as health insurance coverage, personal income, educational attainment, race/ethnicity, cigarette smoking, and obesity, residence in a low social capital area was still associated with about a 40% excess risk of reporting poor health.

In another study also using BRFSS data, independent effects were observed for mistrust, even after controlling for other contextual effects such as income inequality and median income, in addition to adjusting for individual socioeconomic status (Subramanian, Kawachi, & Kennedy, 2001). Empirical evidence from other countries, such as Sweden and Finland, have suggested links between community social capital and lower prevalence of high-risk health behaviors, as well as mental health problems.

In addition to health outcomes at the state level, social capital has been examined in relation to neighborhood-level outcomes. A study based on the 343 neighborhoods of Chicago city found that the degree of social cohesion in a neighborhood (assessed, e.g., by the extent to which residents said their neighbors could be trusted), combined with their willingness to intervene for the public good, was a significant predictor of juvenile delinquency, crime victimization, and homicide rates (Sampson, Raudenbush, & Earls, 1997). In the same study, neighborhood variations in trust, reciprocity, and group membership were significantly correlated with overall and cause-specific mortality rates (including cardiovascular disease mortality rates), even after control for levels of socioeconomic deprivation (Lochner et al., 2003).

Recent investigations on whether community levels of trust influence health outcomes after controlling for individual perceptions of the trustworthiness of other members of the community have revealed a complex pattern of interactions between individual perceptions and community aggregate levels of trust. A multilevel analysis of the 2000 Social Capital

Benchmark Survey (conducted in 40 U.S. communities) showed that while controlling for individual trust perception rendered the main effect of community social trust statistically insignificant, a complex interaction effect was also observed, such that the health-promoting effect of community social trust was significantly greater for individuals expressing higher trust of others. On the other hand, for individuals expressing mistrust of others, higher community levels of trust were associated with an effect in the opposite direction, that is, living in higher-trust communities was associated with worse health status for low-trust individuals (Subramanian, Daniels, & Kawachi, 2002).

### MECHANISMS LINKING SOCIAL CAPITAL TO HEALTH OUTCOMES

The precise mechanisms underlying the connection between social capital and health remain to be teased out, but a great deal of evidence from epidemiology suggests that social support is an important determinant of longevity and quality of life (Kawachi & Berkman, 2000). Leaving aside the obvious point that access to mutual support can enhance individual well-being (e.g., through the ability to buffer the effects of stress—such as borrowing cash or arranging child care in a medical emergency), there are other, plausible mechanisms by which social capital may influence health outcomes. These mechanisms, reviewed by Kawachi and Berkman, include

- a. a community's ability to enforce healthy norms (also referred to as "collective efficacy"), such as through collective action to introduce smoking restrictions in public places via local ordinances;
- b. collective action to garner health-promoting services and amenities (e.g., lobbying to improve access to recreational facilities, such as bike paths); and
- c. diffusion of innovation through information channels (e.g., enhanced knowledge and community awareness of innovations, such as new forms of cancer screening).

### THE DOWNSIDES OF SOCIAL CAPITAL

For all the potential benefits of social capital, it is not a panacea for health promotion. Like any form of capital (such as financial capital), social capital can be used for desirable as well as undesirable ends. Strong social ties *within* a particular group or community

(strong "bonding" social capital) may coexist with conflict *between* that social group and outside social groups. For instance, in India, a high level of social cohesion within Hindu and Muslim communities is not sufficient to prevent ethnic conflict. Strong *bridging* forms of social capital—represented by networks of civic engagement that bring Hindu and Muslim urban communities together, as exemplified by integrated business organizations, trade unions, and political parties—are necessary to prevent the outbreak of ethnic violence (Varshney, 2002). Some forms of association, such as criminal gangs and the Mafia, may provide social capital to its members, but do very little to foster social cohesion in the rest of society.

In addition, social connectedness is not universally or necessarily associated with beneficial health outcomes. If group norms encourage deleterious behaviors (such as within networks of injection drug users), being connected to such groups will not promote health. Communities characterized by strong social bonds may also imply certain restrictions on individual freedom, as well as pressures to conform and to reciprocate social support. Given the gendered pattern of caregiving in most societies, women in particular can often end up shouldering the burden of providing the social support to community members. The excessive obligations to provide support to others can become a source of stress. Finally, some critics have accused the concept of social capital of fostering a victim-blaming attitude, in which communities end up being blamed for insufficient bonding and mutual support. These valid criticisms emphasize the care that is warranted in advocating the strengthening of social capital as a health promotion strategy.

—Ichiro Kawachi and  
S. V. Subramanian

*See also* ECOSOCIAL THEORY; INCOME INEQUALITY AND HEALTH; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; SOCIOECONOMIC STATUS AND HEALTH

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## SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH

Over the past 25 years, there have been dozens of articles and now books on issues related to social networks and social support. It is now widely recognized that social relationships and affiliation have powerful effects on physical and mental health for a number of reasons (Berkman & Glass, 2000; Cohen, Underwood, & Gottlieb, 2000; Seeman, 1996).

When investigators write about the impact of social relationships on health, many terms are used loosely and interchangeably including *social networks*, *social support*, *social ties*, and *social integration*. This entry

discusses (1) theoretical orientations from diverse disciplines that are fundamental to advancing research in this area, (2) findings related to mortality, (3) a set of definitions of networks and aspects of networks and support, and (4) an overarching model that integrates multilevel phenomena.

### THEORETICAL ORIENTATIONS

There are several sets of theories that form the bedrock for the empirical investigation of social relationships and their influence on health. The earliest theories came from sociologists such as Émile Durkheim, as well as from psychoanalysts such as John Bowlby, who first formulated attachment theory. A major wave of conceptual development also came from anthropologists including Bott, Barnes, and Mitchell as well as quantitative sociologists such as Fischer, Laumann, Wellman, and Marsden, who, along with others, have developed social network analysis. This eclectic mix of theoretical approaches coupled with the contributions of epidemiologists form the foundation of research on social ties and health.

Durkheim's contribution to the study of the relationship between society and health is immeasurable. Perhaps most important is the contribution he has made to the understanding of how social integration and cohesion influence suicide. Durkheim's primary aim was to explain how individual pathology was a function of social dynamics. In light of recent attention to "upstream" determinants of health, Durkheim's work reemerges with great relevance today.

John Bowlby, one of the most important psychiatrists in the 20th century, proposed theories suggesting that the environment, especially in early childhood, played a critical role in the genesis of neurosis. Bowlby proposed that there is a universal human need to form close affectional bonds. Attachment theory, proposed by Bowlby, contends that the attached figure creates a secure base from which an infant or toddler can explore and venture forth. The strength of Bowlby's theory lies in its articulation of an individual's need for secure attachment for its own sake, for the love and reliability it provides, and for its own "safe haven." Primary attachment promotes a sense of security and self-esteem that ultimately provides the basis on which the individual will form lasting, secure, and loving relationships in adult life.

### Social Network Theory: A New Way of Looking at Social Structure and Community

During the mid-1950s, a number of British anthropologists found it increasingly difficult to understand the behavior of either individuals or groups on the basis of traditional categories such as kin groups, tribes, or villages. Barnes and Bott developed the concept of "social networks" to analyze ties that cut across traditional kinship, residential, and class groups to explain behaviors they observed such as access to jobs, political activity, or marital roles. The development of social network models provided a way to view the structural properties of relationships among people.

Network analysis "focuses on the characteristic patterns of ties between actors in a social system rather than on characteristics of the individual actors themselves and use these descriptions to study how these social structures constrain network member's behavior" (Hall & Wellman, 1985, p. 26). Network analysis focuses on the structure and composition of the network, and the contents or specific resources that flow through those networks. The strength of social network theory rests on the testable assumption that the social structure of the network itself is largely responsible for determining individual behavior and attitudes by shaping the flow of resources that determines access to opportunities and constraints on behavior.

### HEALTH, SOCIAL NETWORKS, AND INTEGRATION

From the mid-1970s through the present, there has been a series of studies consistently showing that the lack of social ties or social networks predicted mortality from almost every cause of death. These studies have been done in the United States, Europe, and Asia. These studies most often captured numbers of close friends and relatives, marital status, and affiliation or membership in religious and voluntary associations. These measures were conceptualized in any number of ways as assessments of social networks or ties, social connectedness, integration, activity, or embeddedness. Whatever they were named, they uniformly defined embeddedness or integration as involvement with ties spanning the range from intimate to extended.

In the first of these studies from Alameda County, California (Berkman & Syme, 1979), men and women who lacked ties to others (in this case, based on an

index assessing contacts with friends and relatives, marital status, and church and group membership) were 1.9 to 3.1 times more likely to die in a 9-year follow-up period than those who had many more contacts.

Another study, in Tecumseh, Michigan (House, Robbins, & Metzner, 1982), showed a similar strength of positive association for men, but not for women, between social connectedness/social participation and mortality risk over a 10- to 12-year period. An additional strength of this study was the ability to control for some biomedical predictors assessed from physical examination (e.g., cholesterol, blood pressure, and respiratory function).

Similar results from several more studies have been reported from studies in the United States and three from Scandinavia. Investigators working on a study from Evans County, Georgia, found risks to be significant in older White men and women even when controlling for biomedical and sociodemographic risk factors although some racial and gender differences were observed. In Sweden, two studies reported significantly increased risks among socially isolated adults. Finally, in a study of 13,301 men and women in eastern Finland, Kaplan and associates (1988) have shown that an index of social connections predicts mortality risk for men but not for women, independent of standard cardiovascular risk factors.

Studies of older men and women confirm the continued importance of these relationships into late life (Seeman et al., 1993). Furthermore, two studies of large cohorts of men and women in a large health maintenance organization (HMO) and 32,000 male health professionals (Kawachi et al., 1996) suggested that social networks are, in general, more strongly related to mortality than to the incidence or onset of disease.

Two recent studies of Danish men (Penninx et al., 1997) and Japanese men and women (Sugisawa, Liang, & Liu, 1994) further indicated that aspects of social isolation or social support are related to mortality. Virtually all of these studies found that people who are socially isolated or disconnected to others are between 2 and 5 times the risk of dying from all causes compared to those who maintain strong ties to friends, family, and community.

Social networks and support have been found to predict a very broad array of other health outcomes from survival post-myocardial infarction to disease progression, functioning, and the onset and course of infectious diseases.

## A CONCEPTUAL MODEL LINKING SOCIAL NETWORKS TO HEALTH

Although the power of measures of networks or social integration to predict health outcomes is indisputable, the interpretation of what the measures actually measure has been open to much debate. Hall and Wellman have appropriately commented that much of the work in social epidemiology has used the term *social networks* metaphorically since rarely have investigators conformed to more standard assessments used in network analysis. This criticism has been duly noted and several calls have gone out to develop a second generation of network measures.

A second wave of research developed in reaction to this early work and as an outgrowth of work in health psychology that turned the orientation of the field in several ways. These social scientists focused on the qualitative aspects of social relations (i.e., their provision of social support or, conversely, detrimental aspects of relationships) rather than on the elaboration of the structural aspects of social networks.

Most of these investigators follow an assumption that what is most important about networks is the support functions they provide. While social support is among the primary pathways by which social networks may influence physical and mental health status, it is *not* the *only* critical pathway (Berkman & Glass, 2000). Moreover, the exclusive study of more proximal pathways detracts from the need to focus on the social context and structural underpinnings that may importantly influence the types and extent of social support that is provided.

To have a comprehensive framework in which to explain these phenomena, it is helpful to move "upstream" and return to a more Durkheimian orientation to network structure and social context. It is critical to maintain a view of social networks as lodged within those larger social and cultural contexts that shape the structure of networks. In fact, some of the most interesting work in the field today relates social affiliation to social status and social and economic inequality.

Conceptually, social networks are embedded in a macro-social environment in which large-scale social forces may influence network structure, which, in turn, influences a cascading causal process beginning with the macro-social to psychobiological processes to affect health. In this framework, social networks are embedded in a larger social and cultural context in which upstream forces are seen to condition

network structure. Serious consideration of the larger macro-social context in which networks form and are sustained has been lacking in all but a small number of studies and is almost completely absent in studies of social network influences on health.

Networks may operate at the behavioral level through at least four primary pathways: provision of social support, social influence, in social engagement and attachment, and access to resources and material goods. These psychosocial and behavioral processes may influence even more proximate pathways to health status including (1) direct physiological responses; (2) psychological states including self-esteem, self-efficacy, and depression; (3) health-damaging behaviors such as tobacco consumption or high-risk sexual activity, and health promoting behavior such as appropriate health service utilization and exercise; and (4) exposure to infectious disease agents such as HIV, other sexually transmitted diseases (STDs), or tuberculosis.

The following sections review the four primary pathways by which networks may influence health. The reader is referred to Berkman and Glass (2000) for a lengthier review.

### The Assessment of Social Networks

Social networks might be defined as the web of social relationships that surround an individual and the characteristics of those ties (Fischer et al., 1977). Burt (1982) has defined network models as describing "the structure of one or more networks of relations within a system of actors." Network characteristics cover.

- Range or size (number of network members)
- Density (the extent to which the members are connected to each other)
- Boundedness (the degree to which they are defined on the basis of traditional structures such as kin, work, neighborhood)
- Homogeneity (the extent to which individuals are similar to each other in a network)

Related to network structure, characteristics of individual ties include

- Frequency of contact
- Multiplexity (the number of types of transactions or support flowing through ties)

- Duration (the length of time an individual knows another)
- Reciprocity (the extent to which exchanges are reciprocal)

### Downstream Social and Behavioral Pathways

#### *Social Support*

Moving downstream, we now come to a discussion of the mediating pathways by which networks might influence health status. Most obviously, the structure of network ties influences health via the provision of many kinds of support. This framework immediately acknowledges that *not all* ties are supportive and that there is variation in the type, frequency, intensity, and extent of support provided. For example, some ties provide several types of support while other ties are specialized and provide only one type. Social support is typically divided into subtypes, which include emotional, instrumental, appraisal, and informational support. Emotional support is related to the amount of “love and caring, sympathy and understanding and/or esteem or value available from others” (Thoits, 1995). Emotional support is most often provided by a confidant or intimate other, although less intimate ties can provide such support under circumscribed conditions.

Instrumental support refers to help, aid, or assistance with tangible needs such as getting groceries, getting to appointments, phoning, cooking, cleaning, or paying bills. House identifies instrumental support as aid in kind, money, or labor. Appraisal support, often defined as the third type of support, relates to help in decision making, giving appropriate feedback, or help deciding which course of action to take. Informational support is related to the provision of advice or information in the service of particular needs. Emotional, appraisal, and informational support are often difficult to disaggregate and have various other definitions (e.g., self-esteem support).

Perhaps even deeper than support are the ways in which social relationships provide a basis for intimacy and attachment. Intimacy and attachment have meaning not only for relationships that we traditionally think of as intimate (e.g., between partners, parents and children) but for more extended ties. For instance, when relationships are solid at a community level, individuals feel strong bonds and attachment to places (e.g., neighborhood) and organizations (e.g., voluntary and religious).

#### *Social Influence*

Networks may influence health via several other pathways. One pathway that is often ignored is based on social influence. Shared norms around health behaviors (e.g., alcohol and cigarette consumption, health care utilization) might be powerful sources of social influence with direct consequences for the behaviors of network members. These processes of mutual influence might occur quite apart from the provision of social support taking place within the network concurrently. For instance, cigarette smoking by peers is among the best predictors of smoking for adolescents. The social influence that extends from the network’s values and norms constitutes an important and underappreciated pathway through which networks affect health.

#### *Social Engagement*

A third and more difficult-to-define pathway by which networks may influence health status is by promoting social participation and social engagement. Participation and engagement result from the enactment of potential ties in real-life activity. Getting together with friends, attending social functions or church, participating in occupational or social roles, and participating in group recreation are all instances of social engagement. Thus, through opportunities for engagement, social networks define and reinforce meaningful social roles including parental, familial, occupational, and community roles, which, in turn, provides a sense of value, belonging, and attachment. Several recent studies suggest that social engagement is critical in maintaining cognitive ability (Bassuk, Glass, & Berkman, 1999) and reducing mortality (Glass, Mendes de Leon, Marottoli, & Berkman, 1999).

In addition, network participation provides opportunities for companionship and sociability. Rook (1990) argued that these behaviors and attitudes are not the result of the provision of support per se, but are the consequence of participation in a meaningful social context in and of itself. One reason measures of social integration or “connectedness” may be such powerful predictors of mortality over long periods of follow-up is that these ties give meaning to an individual’s life by virtue of enabling him or her to participate in it fully, to be obligated (in fact, often to be the provider of support), and to feel attached to his or her community.

*Person-to-Person Contact*

Another behavioral pathway by which networks influence disease is by restricting or promoting exposure to infectious disease agents. In this regard, the methodological links between epidemiology and networks are striking. What is perhaps most remarkable is that the same network characteristics that can be health promoting can at the same time be health damaging if they serve as vectors for the spread of infectious disease. Efforts to link mathematical modeling applying network approaches to epidemiology are in their infancy and have started to appear over the past 10 years.

The contribution of social network analysis to the modeling of disease transmission is the understanding that in many if not most cases, disease transmission is not spread randomly throughout a population. Social network analysis is well suited to the development of models in which exposure between individuals is not random but rather is based on geographic location, sociodemographic characteristics (age, race, gender), or other important characteristics of the individual such as socioeconomic position, occupation, and sexual orientation. Furthermore, because social network analysis focuses on characteristics of the network rather than on characteristics of the individual, it is ideally suited to the study of diffusion of transmissible diseases through populations via bridging ties between networks, or uncovering characteristics of ego-centered networks that promote the spread of disease.

*Access to Material Resources*

Surprisingly little research has sought to examine differential access to material goods, resources, and services as a mechanism through which social networks might operate. This, in our view, is unfortunate given the work of sociologists showing that social networks operate by regulating an individual's access to life opportunities by virtue of the extent to which networks overlap with other networks. In this way, networks operate to provide access or to restrict opportunities in much the same way the social status works. Perhaps the most important among studies exploring this tie is Granovetter's (1973) classic study of the power of "weak ties" that on the one hand, lack intimacy, but on the other hand, facilitate the diffusion of influence and information, and provide opportunities for mobility.

This entry has identified five mechanisms by which the structure of social networks might influence disease patterns. While social support is the mechanism most commonly invoked, social networks also influence health through additional behavioral mechanisms including (1) forces of social influence, (2) levels of social engagement and participation, (3) the regulation of contact with infectious disease, and (4) access to material goods and resources. To date, the evidence linking aspects of social relationships to health outcomes is strongest for general measures of social integration, social support, and social engagement. However, these mechanisms are not mutually exclusive. In fact, it is most likely that in many cases they operate simultaneously.

## CONCLUSION

The aim in this entry was to integrate some classical theoretical work in sociology, anthropology, and psychiatry with the current empirical research under way on social networks, social integration, and social support. Rather than review the vast amount of work on health outcomes, which is the subject of several excellent recent papers, the entry developed a conceptual framework that might guide work in this field in the future.

—Lisa F. Berkman

NOTE: This entry is adapted from L. F. Berkman and T. Glass, "Social Integration, Social Networks, Social Support and Health," in L. F. Berkman and I. Kawachi (Eds.), *Social Epidemiology*, 2000, New York: Oxford University Press.

See also ALAMEDA COUNTY STUDY; CAREGIVING AND STRESS; SOCIAL CAPITAL AND HEALTH; SOCIAL OR STATUS INCONGRUENCE; SOCIOECONOMIC STATUS AND HEALTH; SUPPORT GROUPS AND HEALTH

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## SOCIAL MARKETING

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Social marketing is a systematic process to change behavior. The simplest way to intuitively understand social marketing and its importance is its relations to commercial marketing. The premise is, "Why can't people be persuaded to change behaviors that benefit themselves and society the same way they would be persuaded to purchase a product or service?" Social marketing is a viable "population" means to address an assumption that all people are entitled to equitable health and well-being, a protected environment, and communities that welcome their participation. It has been applied to a wide variety of health and societal issues.

### DEFINITIONS

*Social marketing.* There are several definitions of social marketing and all share the following six elements: (a) application of commercial marketing principles for the purpose of pro-social benefits; (b) translation of marketing knowledge and scientific evidence into effective interventions; (c) utilization of a philosophy or principles where the consumer is foremost and all strategies begin with the consumer, behavior change is the bottom line, and benefits outweigh costs; (d) adoption of social messages to voluntarily change beliefs, values, attitudes, and behaviors of individuals within target audiences; (e) integration of marketing concepts called the 4 Ps (product, price, place, and promotion) to promote an idea appealing to segments of the population or target groups that have been identified based on data; and (f) application of an ongoing process that includes planning; development, testing, and refinement;



implementation; and evaluation. In simplest terms, social marketing applies marketing principles and is a strategy that requires application of the 4 *Ps* that are blended based on the exchange of costs and benefits to motivate a targeted group to change behaviors that benefit the individual and society.

*Commercial social marketing.* Another type of social marketing is commercial social marketing. Commercial social marketing is a for-profit company or organization that offers a good or service to increase sales, but also has a pro-social benefit to the individual and society. An example is a commercial vendor offering strategies for weight reduction. The similarities between social and commercial social marketing are that both ascribe to the same six elements (a-f) as noted above. The *consumer* in both cases is paramount, and both concentrate on changing behaviors that result in pro-social outcomes.

*Health communication.* There are forms of health communication that have been mistaken for social marketing. One example is social advertising. Social advertising focuses only on one concept of social marketing, which is known as “promotion” (explained in more detail below). Social advertising uses advertising campaigns to inform and influence public beliefs, values, attitudes, and behaviors. Social advertising may or may not be developed with the consumer’s wants and needs in mind. Although social advertising is an important part of social marketing, social advertising is insufficient unto itself. Social marketing requires the use and blending of a finite set of social marketing concepts and not relying on any single one.

## HISTORY AND IMPORTANCE

G. D. Wiebe, from the field of commercial marketing, originally raised the issue in 1952 of marketing social causes like commercial products when he asked, “Why can’t you sell brotherhood like you sell soap?” The question today is, “Why can’t we sell healthy lifestyle practices or behavior change like sleek cars?” What makes these notions titillating is if objects that are common and have no utilitarian value such as the “Pet Rock” in the 1970s and the “Pocket Stones” in 2000 can make million-dollar profits, then surely, it could be reputed that if marketing strategies were applied to products of social importance, efficacy would be similar. However, the public may

perceive products of social importance as less valuable or useful than even the Pet Rock or Pocket Stones, making the application of social marketing principles even more essential to behavior change professionals.

It was not until the early 1970s that social marketing became eminent when Philip Kotler and Gerald Zaltman coined the term. In 1971, their article “Social Marketing: An Approach to Planned Social Change” appeared in the *Journal of Marketing* and discussed the premise that commercial marketing principles and techniques might be effectively applied to promote socially relevant behaviors. Early adopters of the concept focused on social advertising and not social marketing.

Ironically, even though social marketing was conceptualized in the United States, much of social marketing application has occurred in other countries such as Canada (Ottawa), Scotland, and South Africa. Only within the past two decades has the United States shown serious interest in applying social marketing. In 1997, Lefebvre and Rochlin reported to the Institute of Medicine of the National Academy of Sciences that there was a need in the United States for social marketing research in critical areas, including collection and analysis of consumer data to include classifying and selecting audience segments, and channels and design of appealing messages.

The importance of social marketing is the use of a marketing strategy to “tip the balance” so benefits outweigh barriers. The benefit and cost exchange may be perceived by the consumer as negatively balanced because usually the request is change of a habitual and recalcitrant behavior that has offered immediate positive reinforcement such as overeating, drinking, smoking, inactivity, and sexual behaviors. If these behaviors were ameliorated, health outcomes might be delayed and less satisfying. Therefore, the consumer might perceive the product (new behavior) as undesirable or having low appeal. Social marketing holds promise for shifting this balance so that consumers perceive the new behavior as having a greater value than the cost.

## KEY TERMS

Integral to social marketing is a development, implementation, and evaluation process that respects the perspectives, interests, and desires of the target audience. Concepts investigated using this process include the following: (a) audience segmentation,

(b) marketing 4 *Ps*, and (c) marketing mix. These terms and the process are explained below:

*Development, implementation, and evaluation process.* A multistage process used in social marketing is illustrated as a circle including as many as six stages where data are regularly collected. Data are collected during each stage because the primary objective is to meet the needs, interests, and wants of the target audience with continuous input from them. Specific activities for the first stage of planning and strategy selection include reviewing available data, identifying existing activities and gaps, writing goals and objectives, gathering new data, determining target audiences, establishing an audience tracking system, assessing resources, drafting communication strategies, and writing a program plan and timetable. Activities for the second stage of selecting channels and materials involves choosing the communication channels, considering public service media, identifying messages and materials, and deciding whether to produce new materials. The third stage of developing materials and pretesting involves developing and testing message concepts, creating draft materials, pretesting, and making changes based on the results of the pretesting. Fourth-stage activities for program implementation consist of preparing to introduce the intervention, conducting process evaluations, collaborating with partners, and reviewing and revising the intervention. Activities for the fifth stage of assessing effectiveness comprise deciding on the evaluation design, selecting/developing evaluation measures, and conducting outcome and impact evaluations. The last stage of feedback to refine the program entails refining the intervention if needed and communicating the efficacy of the intervention.

These six stages have been simplified to three phases: (a) preproduction/prepromotion, (b) media development and testing, and (c) application and evaluation. Preproduction/prepromotion includes Stages 1 and 2 in the “pinwheel,” media development and testing includes Stage 3, and application and evaluation are represented by Stages 4-6.

*Audience segmentation.* Audience segmentation is a process of subdividing a population into homogeneous (similar) segments or target audiences who are more like each other than members of other or larger groups. The purpose is to better describe and understand a target audience and to predict behaviors in

order to formulate tailored messages and programs to meet specific needs. Audience segmentation can be conceptualized as a population divided according to a “nested hierarchy,” where decreasingly smaller similar segments are derived from larger more dissimilar ones.

Individuals can be divided into segments as follows: (a) similarity or sharing of antecedent characteristics that influence the behavior in question, and (b) exposure to similar preferred or trusted communication channels. Segmenting audiences can be based on demographic, socioeconomic, geographic, psychological, biological, and physiological characteristics and media correlates to develop and tailor messages and campaigns to the specific wants, needs, and perspectives of a particular segment. Another means of segmenting audiences is the use of constructs or variables from various marketing and behavioral theoretical models. Data can be collected by investigators or through secondary data sources. Secondary data are data collected by another researcher, and are often available at the local, state, regional, and national levels. Data also can be used that result in the marketing mix.

*Marketing 4 Ps.* The marketing 4 *Ps* are product, price, place, and promotion. In commercial marketing, the product refers to goods and services. There are many examples of goods (cars, appliances, and electronic equipment) and services (hair styling, lawn care, and automotive repair). In social marketing, the product is behavior change. Examples of social marketing products are using a condom during sexual activity, obtaining a mammogram to detect breast cancer, enrolling in an alcohol prevention program, and modifying one’s lifestyle to reduce cardiovascular risk.

Product can be divided into three levels: core, actual, and augmented. Core product is the benefit to the individual and society from a pro-social activity. The benefit may be related to health promotion, illness and injury prevention, environmental protection, or community involvement. An example of a benefit related to health promotion and illness/injury prevention is regular exercise resulting in improved general health and musculoskeletal fitness to avoid falls. Actual product is the specific behavior(s) necessary to achieve the core product. An example might be 30 minutes of brisk walking 3 to 5 days/week. Augmented product is the additional interpersonal and situational influences that support engaging in the behavior. An

example of augmented product is a map of walking trails in a community or walking with a friend.

Another conceptualization of product includes positive and negative core and tangible product. This conceptualization adds negative core product to core, actual, and augmented. Negative core product is the negative or undesirable effect of engaging or participating in the behavior. An example is muscle soreness following initiation of physical activity.

Price is the cost the consumer associates with the new behavior. The number of price categories varies, but some are monetary, time, psychological, physical, and opportunity. Monetary is financial investment; time is temporal units required; psychological is emotions (such as anxiety, guilt, and embarrassment); physical is pain and suffering; and opportunity is giving up pleasure, comfort, and the security required to engage in the behavior. An essential concept related to price is exchange. Exchange means that the product must be worth the price. In other words, the new behavior must be worth more to the individual than what it costs the person.

Place is where and when the behavior will occur. Place includes access, convenience, and pleasantness associated with engaging in the new behavior while making the existing or competing behavior less convenient or pleasant. Place can be divided into the categories of personal and nonpersonal. Personal place may refer to individuals or professionals who make the task of engaging in the behavior easier and more pleasant, for example, a personal trainer who provides individualized instruction about how to exercise safely. Nonpersonal place may refer to the location and appeal that make the task of engaging in the behavior more accessible and attractive, for example, engaging in physical activity in an appealing exercise facility that is nearby.

Promotion is persuasion that the product (positive benefits of the behavior) is greater than the price (negativism toward the behavior). Promotion involves selecting the following: (a) content or actual “best” words and “ideal” images; (b) incentives, rewards, or benefits for taking action (e.g., health benefits, reduced price, coupons, rebates, gifts); (c) effective communication channel(s) either by mass communication (e.g., television, radio, billboards, newspapers, magazines, governmental signage), selective communication (e.g., letters, direct mail, flyers, brochures, posters, special events, telemarketing, Internet), and/or personal communication (e.g., face-to-face meetings, telephone conversations, workshops, seminars, training sessions); (d) a

spokesperson who is credible and appealing to the target audience; and (e) the timing or when to initiate the campaign (e.g., designated health month, week, or day; period of heightened awareness), duration/frequency of the campaign, and communication channels (reach).

*Marketing mix.* This term equates to taking into account and integrating or blending information of the 4 *Ps*. These blended data form the basic core or building blocks for designing an intervention tailored and targeted to a specific audience segment. The marketing mix is used to produce the desired behavioral response in the target audience.

## INTEGRATION WITH THEORIES/FRAWORKS

Incorporating various behavioral theories can enhance social marketing throughout the development, implementation, and evaluation processes. Theoretical constructs can be used to help clarify the needs, interests, and wants of the target audience. An example of a behavioral theory that has been integrated into each of the 4 *Ps* is the theory of planned behavior (e.g., value/expectancies integrated into product and barriers into price). Other theories/frameworks that have been used in conjunction with social marketing are operationalizing the 4 *Ps* based on marketing theory, and conceptualizing the marketing message as a “minimal intervention” and focusing on recruitment to programs as central issues based on the stepped approach model. Other theories and theoretical constructs that might be used to supplement or enhance the marketing 4 *Ps* include social cognitive theory and the construct of self-efficacy, the health belief model, transtheoretical model of behavior change, diffusion of innovation, communication of persuasion, and extended parallel process model.

In pursuit of a “master” theory, several of the aforementioned theories might be integrated within a social marketing perspective. When integrating a theory or theories into social marketing, the emphasis should always be on audience segmentation, the 4 *Ps*, and the marketing mix. All of the social marketing constructs should be considered in all stages of the pinwheel.

## EXAMPLES OF APPLICATIONS, OUTCOMES, AND REACH

Select examples of interventions are presented that exemplify the use of social marketing, as it is

described above. Representative applications have been to increase breast cancer screening use of at-risk women from diverse ethnic origins; breastfeeding among women enrolled in the National Women, Infants, and Children Program; and student attendance at a university alcohol prevention program. In all cases, Stages 1 and 2, formative data collection procedures, included questionnaires, in-depth interviews, and focus groups. In addition, all programs used the 4 *Ps* in their assessment of demographics and psychographics (e.g., barriers, facilitative factors, knowledge, attitudes, and beliefs). Also the 4 *Ps* were used for Stage 3 in developing materials, which were pretested for the identified specific audience segments. Stage 4, implementation, occurred according to the pretesting results. Stages 5 and 6 should involve appropriate assessments of efficacy and program refinement.

A detailed heuristic illustration of application of social marketing using the six stages is provided related to promoting breast cancer screening services. Stage 1 involved a literature review to identify the target audience and data collection needs and methods. Qualitative and quantitative data were used to identify women's perceptions about mammography. These data were used to segment the audience to target older, low-income women and to identify benefits and costs of using mammography screening and channels and spokespersons for promotion. Behavioral objectives for audience segments were written. Meetings were held with community informants to develop a marketing plan based on the 4 *Ps*.

Results of Stage 2 identified female physicians and breast cancer survivors as spokespersons for all promotional materials. A mix of channels was considered that included television, radio, educational pamphlets, posters, and discount coupons. Television was used to create the program's image, and radio was used to provide more detailed information about the need for screening and how to access services. All materials emphasized annual mammograms, early detection, and serenity.

Stage 3 resulted in colorful materials depicting women 50 years and older representing diverse backgrounds. Materials were pretested in three pilot sites. Two of three themes, annual mammography and serenity, were considered to have the most potential impact. Stage 4 introduced the program in three sites. Process evaluation was suggested to include tracking the number of phone calls, collecting demographic

data of telephone inquirers, and field notes to document compliance and barriers to implementing the program. Stage 5 was suggested as the number of women who scheduled a mammogram, were satisfied with the program, and intended to schedule future mammograms. Stage 6 was not reported but would include examining process data to improve the program and its implementation.

The reach of social marketing is both national and international. Academies, agencies, organizations, and institutions throughout the world use social marketing. For example, social marketing is used by the National Cancer Institute (<http://www.nci.nih.gov/>); National Heart, Lung, and Blood Institute (<http://www.nhlbi.nih.gov/health/prof/heart/other/whhw.pdf>); World Health Organization (<http://www.who.int/en/>); Population Services International ([www.psiwash.org](http://www.psiwash.org)); Centers for Disease Control and Prevention (<http://www.cdc.gov>); Health Canada (<http://www.hc-sc.gc.ca/hppb/socialmarketing>); and the U.S. Environmental Protection Agency (<http://www.epa.gov/opcustsv/selbyppt/tsld014.htm>). Examination of reach indicates use in agriculture, environment, health, and industry. Social marketing is widely used and applied to promote behavior change.

## SUMMARY

Social marketing has appeal because it is comprehensible and understandable based on its origin and success in commercial marketing. Social marketing is historically recognized as a set of principles from commercial marketing that includes three basic elements and a development, implementation, and evaluation process. Social marketing uses a "bottom-up" process with guidance derived from the target audience rather than the typical "top-down" approach where others make decisions about what is needed and wanted by the target audience. Social marketing is notorious for recognizing that each person will make the ultimate decision about engaging in a behavior. Social marketing begins and ends with the target audience, the people whose behavior is to be influenced. Therefore, a thorough understanding of the needs, wants, and perceptions of the various segments of the target audience is essential.

The bottom line for judging the success of social marketing is behavior change and not satisfaction with the intervention, attitude changes, knowledge gained, and behavioral intentions unless they lead to the desired behavioral outcome. Social marketers are

fanatically consumer centered and outcome oriented. Social marketers rely extensively on data and constant feedback from the target audience so they can develop insights into their needs, wants, and perceptions. These insights then lead to development of an acceptable exchange of value in which both the target audience in the social marketer satisfy their wants and needs by the exchange. Both parties must be satisfied for the exchange and social marketing to be a success in changing behaviors. Future applications of social marketing principles are encouraged to further comprehend, refine, and strengthen social marketing as a viable component of a total effort to resolve many of the health and social issues confronting society.

—David R. Black and  
Carolyn L. Blue

See also COMMUNITY-BASED PARTICIPATORY RESEARCH;  
HEALTH COMMUNICATION; HEALTH LITERACY; HEALTH  
PROMOTION AND DISEASE PREVENTION; KEY INFORMANTS;  
TAILORED COMMUNICATIONS; THEORY OF REASONED  
ACTION

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## SOCIAL OR STATUS INCONGRUENCE

Although many of us believe ourselves and our lives to be exemplary with respect to the consistency in our thoughts and behaviors, much of human

social life and belief is fraught with inconsistencies, contradictions, and contested meanings. The effects of these inconsistencies on human health have been investigated for the past 50 years. In this contribution, research on both social or status incongruence (also referred to as status inconsistency) and cultural consonance (which measures cultural incongruities) will be reviewed and summarized.

### SOCIAL OR STATUS INCONGRUENCE

The hypothesis that discrepancies or inconsistencies in status might be related to health outcomes is derived from more general theories of socioeconomic differences and health. The general perspective on socioeconomic status implicit in most research derives from Max Weber's perspective on status. In this view, individuals in complex societies are ranked according to a number of criteria, including their relationship to the labor market (as assessed by occupation), their skills that can be marketed (as assessed by education), and the degree to which they are rewarded in the market for those skills (as assessed by income). Individuals can be ranked on these dimensions separately or according to some summary measure including all three. Generally speaking, the higher an individual's socioeconomic rank, the better his or her health status.

The question can be posed, however, regarding *nonvertical* dimensions of socioeconomic status. This question was first raised by Everett C. Hughes in 1944 in an article that examined how differences or discrepancies or inconsistencies in status for individuals might be problematic. Keeping in mind that he was writing before the modern civil rights movement, the ideal type that Hughes used for his analysis is instructive. He offered the case of an African American physician in the United States. On the one hand, physicians hold positions of both considerable esteem and considerable economic power. On the other hand, African Americans, as a result of systemic racism in this society, occupy a position with much lower status.

Hughes suggested that there would be considerable frustration and uncertainty in mundane social interaction for an African American physician, because at times he or she might receive the deference due the high status of physician while at others times being the object of racist interactions. This would lead to a lack of predictability in social interaction. At the same time, assuming that his or her sense of self would be

significantly shaped by achievements in educational and occupational status, it would be a stressful and frustrating experience to offer one presentation of self in social interaction (i.e., the successful physician), only to have others respond in terms of a disvalued status (i.e., ethnicity).

This example summarizes the basic hypothesis regarding status incongruence. Researchers generalized Hughes's argument to include all differences along status dimensions. In other words, it was hypothesized that an individual whose occupational status was quite different from his or her educational status would experience the same uncertainties and frustrations that Hughes described. Within social epidemiological research in the 1950s and 1960s, especially in sociology but also in epidemiology, researchers examined closely the relationship between inconsistencies in status (along the traditional dimensions of socioeconomic status) and various health outcomes. These included studies of mental health, rheumatoid arthritis, overall mortality, and especially, coronary artery disease (see Vernon & Buffler, 1988).

Generally speaking, status incongruence was found to be associated with an increased risk of adverse health outcomes. Also during this time, the term *status inconsistency* was proposed to apply to intraindividual discrepancies in status (e.g., the PhD who sells shoes for a living), while the term *status incongruence* was proposed to apply to discrepancies in status within a family unit, especially between husbands and wives (e.g., the PhD married to an auto mechanic). A number of studies showed that these interindividual discrepancies in status between husbands and wives in the United States were associated with adverse health outcomes. Although this terminology was proposed and an understanding of the literature requires that the variety of uses of terms be understood, in this entry the term status incongruence will be used to refer to the intraindividual concept.

Despite the theoretical and empirical yield of the idea of status incongruence, research on the topic in sociology and social epidemiology slowed considerably in the late 1960s and early 1970s, as a result of a series of papers by Hubert M. Blalock (summarized in Whitt, 1983). Status incongruence had typically been operationalized as some kind of difference term, indicating the degree of difference on a status dimension for an individual. Sometimes this was a directional term, that is, the degree to which one dimension exceeded another. At other times no direction was

indicated, that is, the absolute difference between the status dimensions was calculated.

In either case, status incongruence would be used as a variable without reference to an individual's overall socioeconomic status. Blalock argued quite persuasively that examining the discrepancies in status made sense only after the vertical effects of status had been taken into account. In other words, since overall socioeconomic status was known to influence health, examining nonvertical effects made sense only after the vertical effects had been removed. What became apparent, however, was that there was no valid statistical procedure for separating vertical and nonvertical effects *in a single model*; that is, an effect of the vertical dimension and an effect of the nonvertical dimension could not be simultaneously estimated. In all existing research on status incongruence, the effect attributed to status incongruence could have been merely typical socioeconomic status effects masquerading as a discrepancy effect.

While Blalock's critique slowed research on status incongruence in some fields of study, the basic theoretical sense of the concept continued to guide research in other areas. In anthropology in the 1950s and 1960s, a great deal of research was taking place on acculturation (or the degree to which individuals in traditional societies adopted beliefs and behaviors introduced from other, usually more modernized, societies) and health. Mostly these were linear models suggesting that the greater the degree of acculturation, the greater the stress and risk of adverse health outcomes (see Dressler, 1999, for a review). There were several papers, however, that suggested a status incongruence effect. One of the major changes occurring in any community undergoing culture change is a shift in material lifestyles. Higher status comes to be associated with the ability to consume material goods associated with middle-class lifestyles in Europe and North America. Several authors suggested, although did not test directly, the idea that the attempt to satisfy these material aspirations could be stressful if individuals did not have resources (which might include access to paid employment or education qualifications) to make possible the acquisition of that lifestyle.

These ideas from anthropology were then integrated with the status incongruence hypothesis in a series of studies (Dressler, 1993). The association of higher status with the ability to attain a middle-class material lifestyle (which includes the acquisition of

consumer goods such as manufactured furniture, appliances, and stereos as well as behaviors such as watching television, traveling, and reading books and magazines) appears to occur in virtually all societies undergoing modernization or culture change. Changing dimensions of status are not particularly problematic, except that these changes can occur much more rapidly than the economic expansion necessary to provide the access to the paid employment, which, in turn, makes possible the acquisition and maintenance of such a lifestyle. Therefore, virtually by definition, there will be individuals aspiring to such a lifestyle whose economic resources are not congruent with that lifestyle. This is an explicit directional hypothesis, in which the degree to which lifestyle aspirations exceed economic resources is thought to be stressful, but not the reverse.

At about the same time, a methodological solution to the dilemma posed by Blalock in the testing of discrepancy effects appeared in the literature. It was shown that if one assumed that the vertical dimension of status could be estimated using a sum of the separate status variables, then it was possible to estimate a discrepancy effect (Whitt, 1983). One could have, in essence, two variables: the sum of two status dimensions that operationalized the overall vertical effect, and a signed difference between two status dimensions estimating the discrepancy effect. Using this model, effects of what was referred to as "lifestyle incongruity" were found on arterial blood pressure in St. Lucia, Mexico, Brazil, and the African American community in the rural southern United States, as well as on depressive symptoms in the African American community and on disordered glucose metabolism among the Mississippi Choctaw.

Furthermore, the effect turned out not to be a simple matter of economic stresses, although that certainly would be a part of it. But where perceived economic stress was directly measured and controlled for, lifestyle incongruity continued to have an independent effect on health. Furthermore, the effect of lifestyle incongruity was moderated by the perceived availability of social support. This led to the argument that in fact the genesis of the stress associated with incongruities in status was probably in social interaction. Like Hughes's Black physician, an individual aspiring to a higher material lifestyle would be in essence projecting a sense of self into mundane social interaction, a self perception involving one's belief in one's ability to participate in what is basically a

middle-class lifestyle; however, others may respond in mundane social interaction less in terms of status defined by a mutable lifestyle, and more in terms of more fixed status characteristics like occupational or educational status. The person with high status incongruence, then, may fail to receive confirmation of his or her self perception in mundane social interaction, the result being frustration, stress, and ultimately, poorer health outcomes.

The lifestyle incongruity hypothesis has been replicated by a number of researchers in a variety of settings, including studies of blood pressure and mental health in adults, and of cell-mediated immune status in adolescents. These studies have also found that the effects of lifestyle incongruity can be moderated by a number of factors, including household structure, social support, and community characteristics.

One aspect of this research worth noting is that the anthropological studies have moved away from using the conventional status dimensions of survey sociology in favor of the measurement of status in terms more ethnographically authentic. That is, while the importance of the traditional dimensions of status is without question in influencing one's life chances, measures of status such as lifestyle capture the way that status is performed in mundane social interaction.

## CULTURAL CONSONANCE

Incongruence along other dimensions has been explored as well. Cassel, Patrick, and Jenkins (1960) some years ago offered what they called the "cultural incongruity" hypothesis. They were particularly interested in what happened to migrants from rural areas to urban areas, although the same reasoning can be applied to culture change occurring within any community. They offered the following hypothesis: The migrant to a novel setting carries with her a particular understanding of how the world works, in every sense (i.e., what it means to work, how marriages are constituted, how families treat themselves and their neighbors, how to worship—everything). She is confronted, however, with a system for which her understanding may not work. The novel and dominant culture of the new setting must be learned for everyone else's behavior to be understood, and indeed for her to behave in ways that are understandable to others. She must, in other words, adapt to the new setting. Even if she is successful, such adaptation can be stressful and costly, and the

cost of adaptation is written on the body in terms of what we call health. Cassel et al. argued that the less successfully the migrant culturally adapts to the new setting, the higher her risk of disease.

Unfortunately, Cassel and his associates had neither the theoretical nor the methodological tools to move this research forward. Recently, however, methods have been developed to make it possible to test these ideas directly. These studies employ the concept of "cultural consonance" to describe the discrepancy between an individual's behavior within some cultural domain, and the behaviors that are culturally valorized within that domain (Dressler & Bindon, 2000). The measurement of these factors has been made possible by the development of procedures that can be used to determine when in fact there are strongly shared (and hence cultural) models of appropriate beliefs and behaviors in some domain of culture. Then, the degree to which individuals deviate from that shared model can be measured using epidemiological survey techniques. In research both in the United States and in Brazil, it has been shown that there are indeed broadly shared cultural models both of valued lifestyles and of preferred patterns of access to social support. A higher degree of consonance or congruence with the culturally valued models for individuals is associated with lower levels of perceived stress, depressive symptoms, and arterial blood pressure. Furthermore, all of these associations are independent of conventional measures of socioeconomic status and social integration.

The cultural consonance hypothesis is again consistent with the basic ideas that Hughes proposed more than a half century ago. Conventional expectations regarding how life is to be lived are encoded in mental representations that we call cultural models. Many of these cultural models are widely shared, some are highly contested. Where they are widely shared, there are expectations, stemming both from the individual, regarding himself or herself, and from others in the social field, regarding the appropriate range of behaviors for any given individual. When, usually as a result of restricted access to economic resources, an individual is unable to act on these widely shared expectations regarding behavior, he or she is likely to experience frustration, uncertainty in social interaction, and a general sense that life lacks coherence. This can be a profoundly stressful experience that, when continued over a long period of time, can lead to poor health.

## SUMMARY

The status incongruence hypothesis and the cultural congruity hypothesis have been extremely productive with respect to research in social epidemiology. Similarly, there is recent evidence that cultural consonance can be associated with health behaviors such as the decision to use health promotion/disease prevention services and level of participation in treatment support groups for chronic disease. Future studies should explore the broader health implications of these inconsistencies and uncertainties in the social and cultural dimensions of everyday life.

—William W. Dressler

See also CULTURAL FACTORS AND HEALTH; ECOSOCIAL THEORY; HEALTH DISPARITIES; INCOME INEQUALITY AND HEALTH; NEIGHBORHOOD EFFECTS ON HEALTH AND BEHAVIOR; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; SOCIOECONOMIC STATUS AND HEALTH; STRESS, APPRAISAL, AND COPING

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## SOCIAL SUPPORT AND HEALTH.

*See* SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH

## SOCIOECONOMIC STATUS AND HEALTH

Socioeconomic status (SES), traditionally assessed by income, education, and occupation, reflects individuals' material and social resources. Various theories of social stratification emphasize different aspects of SES and suggest different types of measurement. However, virtually all measures of SES are related to morbidity and mortality, suggesting that SES is a pervasive and robust influence on health.

### WHAT IS THE ASSOCIATION OF SES AND HEALTH?

In industrialized countries, SES is related to health at all levels of the socioeconomic hierarchy. It is not simply that those in poverty experience poorer health than those with more income; even individuals well above the poverty level have poorer health than those who are relatively more affluent. At an individual level, the health burden of socioeconomic disadvantage is most acute for the very poorest. At a population level, because a far greater proportion of people are in the middle of the SES distribution than at the extremes, a substantial proportion of health effects related to socioeconomic factors are occurring to those who are not in extreme poverty. Although the association of SES and health extends up to the top of the SES hierarchy, for some health outcomes (e.g., infant mortality), the association is stronger at the bottom than at the top. Thus, while health benefits still accrue as SES improves up to the very top, the marginal benefits of higher SES may diminish at upper levels.

The monotonic relationship of SES and health has been demonstrated with each of the main components of SES. With regard to occupation, the Whitehall studies of British civil servants found that higher occupational grade was associated with lower mortality, not only comparing the lowest-grade civil servants to the highest but also comparing midlevel civil servants to those at the highest levels (Marmot et al., 1991). As noted above, studies of income also reveal lower mortality as income increases, although there is a steeper drop in mortality

associated with increasing income among those with the least income (Adler et al., 1994). Benefits of education also accrue to health not simply from high school graduation but also from college graduation and from graduate degrees (Elo & Preston, 1996), although these benefits may not be equally enjoyed by men and by women and by all racial/ethnic groups.

Given the association of SES with mortality, it is not surprising that SES is also related to morbidity. Incidence and prevalence of most diseases increase as SES decreases. The association is especially strong for cardiovascular disease, arthritis, diabetes, chronic respiratory diseases, and cervical cancer (Adler & Ostrove, 1999). Incidence of mental diseases is also greater among lower-SES populations (Kessler et al., 1994). Among the mental diseases, SES is most closely associated with schizophrenia, substance use, and anxiety disorders. There are a few diseases that show the opposite pattern and are more common among higher-SES individuals. Most notable are breast cancer and malignant melanoma. These associations are partially accounted for by SES-related differences in risk-related behaviors: delayed childbearing with regard to breast cancer and recreational tanning with regard to melanoma.

### WHAT ACCOUNTS FOR THE ASSOCIATION OF SES AND HEALTH?

There is no single factor accounting for the association of SES and health. Several pathways have been identified as summarized below.

*Physical conditions.* Lower-SES individuals are subject to a range of health-damaging conditions. Less affluent populations have greater exposure to adverse living conditions including crowding, poor sanitation, peeling lead paint, substandard housing, proximity to dumpsites, and greater air pollution (Evans & Kantrowitz, 2002). The environmental justice movement has raised awareness of such differential exposure. Environmental justice has been adopted by government agencies, including the Environmental Protection Agency, and has led to policy and zoning reform to ensure a more equal burden of environmental risk.

Physical exposures also occur in the workplace. Lower-SES occupations more often involve manual labor that may place workers at risk for injury and involve greater exposure to toxins. Material conditions, such as car and house ownership, have also been linked to better health and appear to make an independent

contribution to morbidity and mortality above and beyond the standard SES measures (Macintyre, Ellaway, Der, Ford, & Hunt, 1998).

*Access to health care.* Those who are poorer, unemployed, and less educated are less likely to have access to high-quality health care. In the United States, private health insurance is tied to employment, and a substantial segment of the population is uninsured. The uninsured have less access to preventive services, screening and early diagnosis, and high-quality care (Committee on the Consequences of Uninsurance, 2002). Even among those who have access to the same system of health care (e.g., members of health maintenance organizations [HMOs]), lower SES continues to be linked to poorer health outcomes. Knowledge of how to utilize the health system to get higher-quality care (which is likely to be greater among those with more education) may play a role in this association. However, it may also be due to conditions outside of the health care system linked to SES that are affecting outcomes.

*Health behaviors.* Health behaviors are estimated to be responsible for over 40% of premature mortality (McGinnis, Williams-Russo, & Knickman, 2002). Behaviors that are most responsible for premature mortality are smoking, sedentary lifestyle, diet, sexual risk behaviors, and substance use. Rates of these health-risking behaviors increase the lower one's income, education, and/or occupational status. For example, 52% of men with less than a high school education smoke cigarettes compared to 43% of high school graduates and 29% of college graduates (National Center for Health Statistics, 1998).

In addition to behavioral contributions to the onset of disease, SES-related behaviors may affect the course of disease. Treatment for many diseases and conditions requires close adherence to prescribed regimens. For example, the course of diabetes is greatly affected by dietary intake and monitoring of blood glucose. Diabetics with less education have been found to show poorer adherence, and differences in adherence largely account for the association of education and course of disease. Similar findings emerge with regard to adherence to antiretroviral therapy among HIV-positive patients (Goldman & Smith, 2002).

*Psychosocial responses.* Higher SES is associated with greater protection from adverse health effects of stress. Both acute and chronic stress are reported more frequently among those lower on the SES hierarchy.

Possessing more resources, whether from higher education, income, or occupational status, may help people avoid situations that are stressful and also help them cope more effectively with those that they do encounter. It is easier to engage in active coping strategies, which are generally associated with better health, when one has more resources with which to address threatening situations. The wear-and-tear on the body of responding to more frequent and chronic exposures to stress heighten the risk of dysregulation of the HPA axis, which is central to the stress response and to the development of disease (McEwen, 2002).

More threatening and adverse environments associated with lower SES may engender psychological responses that increase the risk of disease. Hostility, anger, optimism/pessimism, sense of control, and social support, all of which are associated with disease risk, are also related to SES. Though few studies have directly tested whether these psychological variables mediate the impact of SES on disease, there are numerous studies showing that they are related, on the one hand, to SES and, on the other hand, to disease risk (Gallo & Matthews, 2003).

*Health affects SES.* While the predominant causal direction appears to be from SES to health, health may also affect SES. Individuals who are in poorer health may be less likely to achieve higher SES status. Children from poorer families are reported by their parents to have worse health (Case & Paxson, 2002). Poorer health in childhood can contribute to missed school and lower achievement. The impact of health on educational attainment is likely to be greatest from diseases that have their onset during childhood and adolescence (e.g., asthma, schizophrenia). In later life, those who become ill may be less likely to be able to work, affecting their income and occupational status (Smith, 1999).

#### HOW DOES SES RELATE TO RACE/ETHNICITY AND GENDER?

People of color in the United States generally have poorer health status than do White European Americans. For example, compared to Whites, African Americans have poorer overall health and higher rates of HIV/AIDS, diabetes, heart disease, cancer, and stroke (Williams, 1999). For some conditions, racial/ethnic group differences become nonsignificant once socioeconomic factors (e.g., income) are controlled for. For other conditions, racial/ethnic group differences remain even after controlling for SES.

These findings suggest that to some extent racial/ethnic health disparities are due to socioeconomic disadvantage but that unique experiences associated with minority status (e.g., experiences of discrimination, residential segregation) also play a role.

Associations of SES with health differ by gender as well as by race and ethnicity. The meaning of a given SES indicator may vary for men versus women and for Whites versus people of color, suggesting the importance of looking at SES influences on health within each group.

—Nancy E. Adler

See also CULTURAL FACTORS AND HEALTH; ECOSOCIAL THEORY; HEALTH DISPARITIES; INCOME INEQUALITY AND HEALTH; NEIGHBORHOOD EFFECTS ON HEALTH AND BEHAVIOR; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; SOCIAL OR STATUS INCONGRUENCE

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## SPIRITUALITY AND HEALTH

For thousands of years, spirituality and health have been closely allied with each other, in concept and in practice. Historically, treatment was administered by religious and spiritual healers. However, with the Age of Enlightenment and the advent of modern medicine, diagnosis and treatment were separated from their spiritual context. Despite this initial separation between health and spirituality, in recent years, a rapprochement has been taking place. Empirical studies are revealing significant links between spirituality and

health. And religious/spiritual and health care communities have begun to join forces in the prevention and treatment of illness and the promotion of health and well-being.

### THE MEANING OF SPIRITUALITY

The term *spirituality* comes from the word *spirit* (to breathe). Although there is a lack of consensus about its precise meaning, there is general agreement that spirituality is a living, dynamic process that is oriented around whatever the individual may hold sacred. The sacred refers to concepts of God, the divine, and transcendence as well as other aspects of life that take on spiritual character and significance by virtue of their association with the divine. Thus, the sacred can also include material objects (e.g., crucifix), special times (e.g., the Sabbath), special places (e.g., cathedral), relationships (e.g., marriage), and psychological attributes (e.g., soul). Spirituality refers to the attempt to discover the sacred, hold on to the sacred, and, when necessary, transform the sacred.

In their search for the sacred, people may take a variety of spiritual pathways. These paths include traditional or nontraditional organized religious beliefs (e.g., God, afterlife, karma), practices (e.g., prayer, meditation, rituals), experiences (e.g., mysticism, conversion), and institutions (e.g., church attendance, Bible study). Pathways to the sacred may also take nonreligious forms, such as walking in the outdoors, listening to music, intimate relations with others, or participating in social action. The richness and complexity of spirituality is a reflection of the many different ways people can define the sacred in their lives and the many different pathways they can follow to discover and rediscover the sacred.

### EMPIRICAL LINKS BETWEEN SPIRITUALITY AND HEALTH

A substantial body of research has examined the relationships between various dimensions of spirituality and health. Studies have shown that both organizational forms of spirituality (e.g., church attendance, religious affiliation) and more private expressions of spirituality (e.g., personal spiritual practices and beliefs, spiritual coping) are related to a variety of health dimensions. Despite the different methodologies used to examine the relationships among these complex constructs, in general, empirical studies

demonstrate that spirituality appears to have beneficial consequences with respect to physical and mental health.

A number of studies have found that greater frequency of attendance at religious services is associated with better health. For example, more frequent worship attendance has been tied to a lower risk of drug and alcohol abuse, sexual promiscuity, and suicidality. Moreover, greater frequency of worship attendance is predictive of a lower risk of mortality even after controlling for relevant demographic, health practice, and other potentially confounding variables. That is, people who attend religious services more frequently have a lower risk of dying, after accounting for other potentially relevant variables, such as age, gender, socioeconomic status, diet, and exercise. Thus, organized forms of spirituality appear to be associated with better health.

More private expressions of spirituality also have important implications for health. For example, personal spiritual practices such as prayer and meditation have typically been linked with better health. Prayer involves an attempt to commune with a supernatural, transcendent, divine presence. People who pray more frequently and describe mystical and positive religious experiences during prayer also report greater feelings of subjective well-being, such as purpose in life, general life satisfaction, and existential well-being. Furthermore, in some studies employing experimental designs using randomized control trials, prayer has demonstrated positive effects on health by reducing chronic pain, muscle tension, anger, and anxiety. Similarly, meditation, clearing the mind, and focusing on one thought as an approach toward transcendental consciousness has been associated with lower levels of anxiety, hostility, depression, and dysphoria and higher levels of positive affect and self-actualization. In intervention studies, people who employ meditation techniques show reduced rates of metabolism. Meditation has also been proven to be an effective treatment for alcoholism, smoking, and illicit drug use.

Spiritual beliefs are another personal form of spiritual expression that have been associated with health benefits. Empirical studies have linked the belief in an afterlife to less depression and death anxiety, lower risk of suicide, and greater recovery from bereavement. Similarly, the belief in a loving God shows generalized health benefits and appears to be particularly valuable to people dealing with specific stressful situations. Among people facing a variety of major life

stressors, religious coping methods that reflect a perceived closeness to God have been associated with better self-rated health and better psychological adjustment. Thus, the belief in a loving God appears to promote health in general and in response to specific stressful situations.

Despite the apparent benefits of spirituality for health, certain aspects of spirituality, such as spiritual struggles, may be a source of considerable strain and distress. Spiritual struggles represent efforts to conserve or transform a spirituality that has been threatened or damaged. Examples of spiritual struggles include anger at God, difficulty forgiving God, feelings of alienation or punishment from God, interpersonal religious conflicts and discontent with family, congregation members, and clergy, and religious doubts, fear, or guilt. Although spirituality generally serves as a protective resource for many people, a growing number of studies demonstrate that spiritual struggles are not uncommon among diverse groups, including medically ill elderly patients, mental health outpatients, college students, adolescents, and people undergoing a variety of life stressors.

Empirical studies have shown that spiritual struggles typically have negative implications for health. For example, various types of spiritual struggles have been associated with psychological distress, anxiety, depression, lower self-esteem, trait anger, posttraumatic stress disorder symptoms, callousness, poorer mental health, and less happiness and life satisfaction. In longitudinal studies, spiritual struggles with the divine have been predictive of poorer recovery among rehabilitation patients and greater risk of mortality among medically ill elderly patients, even after controlling for other potentially important confounding variables.

#### EXPLANATIONS FOR THE LINKS BETWEEN SPIRITUALITY AND HEALTH

Science, with its reliance upon direct observation of behavior, cannot determine whether God exists and intervenes in human affairs to promote health and well-being. However, scholars have offered a variety of plausible worldly explanations for the relationship between spirituality and health. One explanation for the beneficial relationship is that spirituality operates through physiological mechanisms. For example, it has been suggested that spirituality may promote health through the relaxation response. The relaxation response is a self-induced altered state of consciousness

that results in an integrated hypothalamic function, increased plasma noradrenaline levels, and generalized decreased sympathetic nervous system activity. Various spiritual practices (e.g., prayer, meditation) may induce the relaxation response. Preliminary research also suggests that spirituality may affect health through changes in immunological functioning. For example, certain spiritual practices and beliefs have been associated with lower serum cortisol levels and better immune functions among samples of the elderly and persons who are HIV-positive or have AIDS.

Another explanation for the salutary function of spirituality is that spirituality encourages healthy behaviors. For example, a number of empirical studies have demonstrated that people who are more religious are less likely to smoke cigarettes, abuse alcohol and drugs, engage in premarital sex, have multiple sexual partners or extramarital affairs, engage in crime and delinquency, and more likely to wear seat belts. Thus, spirituality may promote health by discouraging risky behaviors and encouraging healthy behaviors.

Psychological explanations have also been offered to account for the relationship between spirituality and health. Spirituality offers meaning, direction, and a sense of coherence. Furthermore, when negative life events are experienced, spirituality enables people to appraise negative events from a different vantage point. Crises become an opportunity for growth, transformation, or intimacy with God. In this regard, spirituality provides hope and may serve as a buffer for negative emotions. Similarly, spirituality may serve as a catalyst for positive emotions. For example, spirituality may enhance feelings of self-esteem and empowerment as people associate themselves with an all-loving, omnipotent God who cares for them and loves them unconditionally.

Scholars have also suggested that spirituality affects health through social means. For example, spirituality offers tangible social support, such as access to information, goods, and services. In addition, spirituality and religious involvement provide various opportunities for companionship and friendship, emotional support, a sense of connectedness, and intimacy. Interpersonal relationships based upon shared religious values and beliefs may lead to a strong sense of affirmation and a secure attachment to others. Thus, spirituality may promote health by enhancing both the quantity and quality of social resources available to people.

Despite the compelling character of such worldly explanations, as yet, empirical studies have not been able to fully account for the links between spirituality and health through physiological, behavioral, psychological, and social means. The possibility remains that there is something distinctive or unique about spirituality that exerts special effects on health. For example, spiritual coping methods (e.g., spiritual support from God, positive spiritual appraisals, spiritual discontent) may offer unique ways of understanding and dealing with life stressors. And psychospiritual virtues (e.g., forgiveness, gratitude, humility), grounded in spiritual values and worldviews, may create healthy attitudes toward oneself and the world that relate, in turn, to healthy lifestyles.

While reasonable explanations have been offered for the beneficial relationship between spirituality and health, the explanation for the harmful roles of spirituality are less clear. It is possible that harmful forms of spirituality may also exert their deleterious effects through physiological, behavioral, psychological, social, and distinctly spiritual means. For example, harmful forms of spirituality may compromise immunological functioning. Particular spiritual beliefs or practices may discourage people from seeking necessary health care or complying with medical treatment recommendations. Religious doubts, fear, and guilt may elicit negative emotions. Interpersonal religious conflicts or discontent with family, clergy, or congregations may result in social alienation. And anger at God, difficulty forgiving God, feelings of alienation or punishment from God, or spiritual discontent may result in a loss of purpose, meaning, or sense of coherence. With more sophisticated empirical studies, explanations for the potentially harmful roles of spirituality will become clearer.

#### SPIRITUALLY SENSITIVE PREVENTION, INTERVENTION, AND PROMOTION

For a number of years, relationships between religious and health care communities have been strained and one-sided. While religious professionals frequently refer people to the health care system, these acts are rarely reciprocated. The bifurcation between religious and health care communities is further evidenced by the relative lack of collaborative and integrated programs. There are, however, exceptions to

this rule, such as 12-step programs that incorporate spirituality into treatment.

More recently, we are beginning to see some new collaborative efforts between religious and health care communities. For example, a growing number of church-based health prevention and health promotion programs have been established. Some low-cost health promotion clinics have been set up in high-access community churches. Other initiatives include church-based programs aimed at reducing cardiovascular risk through behavioral interventions, and educational and promotion programs focusing on cervical cancer, hypertension, nutrition and physical exercise, AIDS, sexuality, drug use, and mental illness. In addition to these church-based health programs, spiritually integrated forms of psychotherapy are rapidly developing. Spiritual practices (e.g., prayer and meditation) are being incorporated into treatment, spiritual issues (e.g., forgiveness, acceptance, serenity) are being addressed in psychotherapy, and behavioral treatments are being used to enhance spirituality.

Collaborative efforts between spiritual and health care communities are still in their infancy. Empirical studies are needed to demonstrate the effectiveness of these spiritually sensitive health-related programs. Nevertheless, these collaborative efforts represent important beginning steps toward the integration of modern scientific health care techniques with established spiritual beliefs and practices, and a return of prevention, diagnosis, and treatment to their original holistic context.

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and Gene G. Ano

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## STRESS, APPRAISAL, AND COPING

It is widely accepted that everyone experiences stress and that stress has deleterious effects on mental and physical health. While it is true that just about everyone experiences stress, it is not true that it always has deleterious health effects. This observation is probably as old as recorded history. Over the past 40 years, it has become the central interest of a number of psychologists working in the areas of cognitive, health, and clinical psychology.

The systematic process of developing and testing hypotheses regarding stress and its effects on health depends on having a theory. In 1966, Richard Lazarus published a landmark book, *Psychological Stress and the Coping Process*, that presented a cognitive theory of stress. This book and its successor, *Stress, Appraisal, and Coping*, published in 1984, laid the foundation for much of the research on psychological stress that has occurred since then.

At the heart of this cognitive theory of stress are two concepts—appraisal and coping—that together help explain why people vary in their judgments as to what is stressful, their emotional responses to the stress, and their coping responses. These processes are contextual; they are shaped by both the person and the environment at a given time. They are also dynamic in that both appraisal and coping change as a situation unfolds.

### APPRAISAL

*Appraisal* is an evaluation of a situation that determines the quality and intensity of a stress response. The appraisal process helps account for differences between individuals' responses with respect to the same event, and it helps account for differences in responses within individuals over time. Stress and coping theory defines two kinds of appraisal, primary appraisal, which is the evaluation of the personal significance of a situation, and secondary appraisal, which is an evaluation of the options for coping.

Primary appraisal is influenced by the person's values, beliefs, and goals, which determine the personal

significance or the meaning of a given situation. A dent in the fender of a car will be more stressful for a person who prizes that car than for a person for whom the car is merely a means of transportation. The threat of a layoff will be more stressful for a person who is the single head of a household than for a person whose income is not critical for a family's well-being.

Secondary appraisal is often cast in terms of personal control—is there something the person can do to control the situation, or is it a situation the person has to accept? This appraisal is often complex. For example, there may be something that can be done to change the outcome of a situation, but to exercise that option may cause conflict elsewhere. This is often the case when money is needed to solve a problem. The money may be needed for more than one purpose. To use it to deal with the immediate problem—say, pay a bill—may mean that another bill goes unpaid.

Together, primary and secondary appraisal determine whether the situation is perceived as stressful—as a harm or loss, a threat, or a challenge. The greater the personal significance and the less adequate the options for coping, the more intense the appraisal of harm, loss, or threat. The appraisals of harm, loss, or threat are accompanied by negatively toned emotions such as fear, anger, worry, or sadness. Challenge refers to the possibility of mastery or gain. It is included as a stress appraisal because challenge always contains the possibility of failure. It is accompanied by positively toned emotions such as eagerness and excitement, as well as negatively toned emotions such as fear.

At the most fundamental level, appraisal has adaptive significance. A failure to appraise a real danger realistically can result in great harm to the individual. Conversely, the failure to evaluate a benign situation realistically will lead to inappropriate responses that can cause difficulty.

### COPING

*Coping* refers to the changing thoughts and behaviors that people use to manage the underlying problem and regulate the emotional response in situations that are appraised as stressful. This is a contextual definition in that coping is a response to the appraised demands—both internal and external—of the situation at hand. The definition also implies that coping is a dynamic process that changes as the appraisal of the person-environment relationship changes over time.

Furthermore, the definition makes no assumptions as to what constitutes good or bad, adaptive or maladaptive coping. A given coping strategy, such as information seeking, may be adaptive in a situation where there is time and a purpose to be served, but it may be maladaptive in a situation where a quick response is necessary. Similarly, a strategy for managing fear such as meditation may be useful when there is nothing that needs to be done immediately, but it could be maladaptive in the case where immediate action is necessary.

### Dimensions

A number of coping dimensions are described in the literature, including one group that has to do with controlling the environment versus controlling oneself: primary control (controlling the environmental problem) and secondary control (controlling one's response to the problem); assimilative (altering the environment) and accommodative (altering oneself); and mastery and meaning. Another group has to do with approach and avoidance, for example, vigilance versus cognitive avoidance. Probably the most commonly used dimensions are those suggested by Lazarus and Folkman: problem-focused coping, which is used to manage underlying problems, and emotion-focused coping, which is used to manage distress.

Regardless of the ways in which they are identified, coping dimensions tend to be interdependent as a stressful encounter unfolds. For example, sometimes it is necessary to engage in emotion-focused coping before proceeding with problem-focused coping, as when a person experiences anxiety just before giving a public address and does some deep-breathing before going to the podium. Sometimes problem-focused coping is used to reduce distress, as when a person makes up a "to-do" list (a problem-focused technique) as a way of reducing anxiety about being overloaded with work. For this reason, people usually use a complex array of coping strategies over the course of an encounter. Greater emphasis is given to problem-focused, vigilant, instrumental, or approach strategies when the situation is appraised as potentially controllable. Greater emphasis is given to emotion-focused, palliative, or avoidant coping in situations that are appraised as not within the individual's personal control.

More recently, several coping researchers identified a gap in the coping literature having to do with coping strategies that are used to generate and sustain

positive emotion. Interest in this type of coping was motivated by findings that people often experience positive emotions during periods of intense stress. Sometimes these emotions are the result of experiences of mastery and competence, sometimes they come from finding some kind of benefit or meaning in adversity. Concepts such as "stress-related growth," "benefit-finding and benefit reminding," and "meaning-focused coping" have entered the coping literature. The measurement of these kinds of coping promises to broaden our understanding of how individuals manage to get through very difficult times.

### Measurement

A number of measures of coping have made their way into the literature. For the most part, these are self-report measures that are consistent with the conceptualization of coping as complex, contextual process involving thoughts and actions to manage problems and regulate distress. Subjects are typically asked to focus on a specific stressful event that is relevant to the research at hand. Sometimes the event was recently experienced (e.g., a layoff or an argument with a spouse), sometimes it is ongoing (e.g., preparing for an exam, waiting for a biopsy result), and sometimes it is in the form of a researcher-originated vignette. Subjects indicate the extent to which they used or are using the coping strategies listed on the checklist, such as gathering information, distracting oneself from the problem, expressing one's feelings, trying to minimize significance, or avoidance through the use of alcohol or drugs. Often factor analyses are conducted to identify specific types of coping, such as problem solving, escape avoidance, distancing, and seeking emotional support. The internal consistency of subscales of coping tends to be in the range of  $\alpha = .6-.8$ , which is lower than psychologists are accustomed to seeing in established measures. The accepted reason for this level of internal consistency is that if a given strategy from a particular scale (such as problem solving) works, people are unlikely to use the other strategies from that same scale. Among the most widely used of the self-report measures are the COPE by Carver, Scheier, and Weintraub (1989), the Coping Responses Inventory by Moos (1997), and the Ways of Coping by Folkman and Lazarus (1988).

Checklist measures of coping have important limitations, including biases and distortions associated



with retrospective approaches, and their inability to capture temporal ordering. New technologies that have become available facilitate the assessment of coping in real time on a daily basis. Subjects are given a general list of types of coping. For each type of coping that the subject indicated he or she used, the subject is to describe exactly what he or she did. Often this type of research is conducted with palm-held computers or personal digital assistants (PDAs).

### HOW DO APPRAISAL AND COPING AFFECT HEALTH?

Stress can affect health in a number of ways. It can have a direct effect through repeated or prolonged activation of the physiological stress response. Although the physiological stress response is adaptive in the short term because it serves to mobilize energy and ready the body to respond physically to the stress (the fight-or-flight response), prolonged or repeated activation of the stress response can have a host of negative consequences including suppressed immune function, increased blood pressure, and endocrine dysregulation, which can increase risk for cardiovascular and other disorders.

Appraisal plays a role in this process because the appraisal determines whether a particular event will be seen as stressful at all (and therefore determines whether the physiological stress response will occur). Two people experiencing the same objective event may have very different physiological reactions because one appraises the situation as a threat and experience the physiological stress response, and the other appraises it as benign and there is no physiological perturbation. Effective coping can shorten the duration of the stress response, and ineffective coping can prolong it. For example, imagine two cars stuck in a traffic jam. The individual in the first car screams at the other drivers, honks her horn, makes obscene gestures, and tries to drive on the shoulder to get ahead. She is clearly trying a number of coping responses, none of which is likely to make the traffic jam resolve more quickly. The second driver calls ahead to her appointment to let them know she has been delayed and decides to take this opportunity to listen to the book on tape she's been meaning to get to. Rather than trying to exert control over the traffic jam, she focuses on things that she can do.

Although they experienced the same objective stressor, the first driver is likely to have a more costly

physiological response than the second driver. If the first driver typically appraises and copes with daily stress in this way, the damage is likely to become more serious over time.

Some coping responses are, in and of themselves, health damaging or health promoting. For example, although smoking or drinking in response to stress may decrease levels of negative emotions, each can have deleterious effects on physical health in the long run. On the other hand, some individuals exercise or meditate in response to stress and these practices can have beneficial effects on health.

Health care seeking in response to a symptom is one pathway through which appraisal and coping play a role after a health problem has occurred. At about the same time that Lazarus was developing his cognitive theory of stress, Howard Leventhal independently developed an appraisal model, the "common sense model of illness representation," concerned specifically with health threats. The appraisal of a health threat revolves around five attributes of an illness representation: its identity (e.g., disease label), the time line (e.g., does the cue signal an acute, chronic, or cyclic condition), the causal attribute (e.g., does the cue occur after a heavy meal, after exercising), the controllability (e.g., its responsiveness to intervention), and the imagined consequences (e.g., personal experience, economic hardship). The same illness representations also evoke emotional responses through a parallel and associated process. The cognitive and emotional processes lead to coping responses to deal with the illness and with the distress associated with its appraisal.

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Tedlie Moskowitz

See also CAREGIVING AND STRESS; EMOTIONS: NEGATIVE EMOTIONS AND HEALTH; JOB STRAIN AND HEALTH; STRESS-BUFFERING HYPOTHESIS; WORK-RELATED STRESS AND HEALTH

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## STRESS: BIOLOGICAL ASPECTS

### THE STRESS RESPONSE

The stress response refers to how the different physiological systems of the body respond to a stressor. A stressor can be either physical, such as the demands imposed on the body by the physical exertion of exercise, or psychological or mental, such as the stress we may experience in our day-to-day lives. These include a student taking an exam, meeting work deadlines, and being stuck in traffic; even winning a lottery ticket can be experienced by some people as a stressor. It is important to keep in mind that not all people experience the same event as stressful. That is, it is more our reaction that determines whether it is stressful rather than any necessarily inherent nature of the event or experience itself.

The stress response as we know it is rooted in an ancient part of our body's physiological responses known as the fight-or-flight response. In this sense, the response first evolved as a mechanism for survival.

It is only when this same response is turned on chronically that it can exert deleterious effects on our physical and mental health.

This section reviews how the major physiological systems of the body are affected by acute and chronic stress.

### Nervous System

The brain regulates body functions at all times. The hypothalamic-pituitary-adrenal axis together with the autonomic nervous system controls the stress response. The hypothalamic-pituitary-adrenal axis consists of the hypothalamus (base of the brain), pituitary gland (below the hypothalamus), and adrenal gland (over the kidneys). The hypothalamus releases corticotropin-releasing factor, which stimulates the pituitary gland to release adrenocorticotrophic hormone. Adrenocorticotrophic hormone in turn stimulates the adrenal gland to release steroids called glucocorticoids (e.g., cortisol). Cortisol acts as a key regulator of the body's stress response. There is a negative feedback system that regulates cortisol levels. When cortisol levels rise, a negative feedback signal to the hypothalamus inhibits further release of corticotropin-releasing hormone. This essential ability of the negative feedback system to limit the production of cortisol is impaired in individuals with a history of chronic emotional/physical stress. Excessive and sustained cortisol secretion has been linked to a host of diseases such as hypertension, depression, and osteoporosis.

The autonomic nervous system is the other part of the nervous system that controls the stress response. The autonomic nervous system consists of two components, a sympathetic nervous system and a parasympathetic nervous system. The two systems work in opposition whereby the activation of one is accompanied by the suppression of the other. The sympathetic nervous system is activated during stress and mediates the fight-or-flight response in which two chemical messengers, epinephrine and norepinephrine, are released from the nerve endings and from the adrenal glands.

What happens to our different body systems during stress is mainly, but not exclusively, regulated by epinephrine, norepinephrine, and glucocorticoids. It is now known that chronic stress may be a precipitating or at least an aggravating factor in many diseases through its effects on different biological systems as is outlined below.

## Metabolism

In response to stress, a mobilization of energy is necessary to deliver nutrients to the muscles that need it the most. Repeated or continuous activation of this system causes depletion of energy stores and increased fatigue, as a simple first consequence. A more drastic consequence of continuous activation may be diabetes mellitus, a disease characterized by an elevation of blood sugar levels. Hormones of the stress response cause glucose and fatty acid mobilization into the bloodstream and also block insulin secretion, causing glucose to accumulate in the blood. Moreover, epinephrine, norepinephrine, and glucose act on fat cells throughout the body to make them less sensitive to insulin (i.e., insulin resistance). The elevated blood sugar levels adversely affect the eyes, kidneys, nerves, and heart. In nondiabetics, chronic stress causes elevation of blood sugar levels with an increased possibility of vascular damage. In diabetics, chronic stress can exacerbate the existing insulin resistance and further disturb metabolic control.

## Cardiovascular System

In response to stress, the activation of the sympathetic nervous system leads to an increase in the rate and force of contraction of the heart accompanied by contraction of the peripheral blood vessels. This causes an increase in blood pressure. This response is designed to divert blood to the muscles that need it the most as part of the fight-or-flight response. However, in the case of repeated or chronic stressors, the increase in blood pressure increases the force with which blood moves through the blood vessels thus resulting in damage and scarring of their inner layer. Subsequently, fatty acids, glucose, platelets, and foam cells (a type of white blood cells) are deposited in the scarred inner layer of the blood vessels. This process leads to the narrowing and hardening of the blood vessels, that is, atherosclerosis.

Myocardial ischemia occurs when the blood vessels feeding the heart have become clogged by atherosclerosis. In this case, the heart itself becomes deprived of the oxygen and glucose it needs for normal functioning, and myocardial ischemia ensues. A most drastic consequence of myocardial ischemia is sudden cardiac death. Acute stress can lead to sudden cardiac death by causing ventricular fibrillation on top of an already ischemic heart.

Cardiovascular disease is the No. 1 killer in the United States today. There is certainly individual variation in the susceptibility to cardiovascular

disease. Behavioral factors such as diet and exercise play a role in this individual variability. Among other behavioral factors that influence one's susceptibility to this debilitating illness is the way an individual tends to respond to stress.

## Immune System

Stress, whether physical or psychological, acute or chronic, leads to major changes in the number and characteristics of the immune cells that circulate in the blood. Immune system responses to stress have been linked to different disease processes such as atherosclerosis, infectious diseases, cancer, and depression. Stress increases an individual's susceptibility to an infection mainly through its effects on lymphocytes (white blood cells that normally fight off infectious agents). Glucocorticoids secreted in response to stress cause shrinkage of the thymus gland in which lymphocytes are formed, thus decreasing the formation of lymphocytes. They also inhibit the release of certain cytokines (chemical messengers secreted by immune cells), thus causing the circulating lymphocytes to become less responsive. This is in addition to the sympathetic nervous system hormones secreted during stress, which also suppress immunity, and can lead to an increase in one's susceptibility to infections.

Accordingly, research has provided evidence for a link between psychological stress and disease progression including HIV infection. There is also accumulating evidence of a link between immune system responses to stress and tumor development and/or progression. One mechanism is through the reduction in the number or activity of natural killer cells (the immune cells that prevent tumors from spreading) that accompanies stress. The association between stress and cardiovascular disease is also mediated through an immunological pathway. The first stages of atherosclerosis are of an inflammatory nature, thus the immune system is also a link between stress and some forms of cardiovascular disease.

## Gastrointestinal System

Stress effects on the gastrointestinal system may manifest in the form of peptic ulcers or functional gastrointestinal disorders such as functional dyspepsia or irritable bowel syndrome. Functional gastrointestinal disorders can be caused by changes in gastric motility due to psychological stress. Stress management

techniques have been found to be effective in reducing symptoms in patients with functional dyspepsia and irritable bowel syndrome.

A more severe consequence of stress is peptic ulcer formation. The vast majority of peptic ulcers are associated with gastric *Helicobacter pylori* infections. However, only a fraction of *Helicobacter pylori*-infected subjects develop an ulcer. Psychological stress is an important cofactor in the process of ulcer formation through a drop in immunity, which increases the likelihood of a *Helicobacter pylori* infection. Stress also decreases the blood flow to the gut (blood is diverted to other muscles that need it more during stress), leading to decrease in the oxygen supply to the stomach walls. This leads to small infarcts in the stomach wall, and it is these necrotic lesions in the gut that are the building blocks for peptic ulcers. Moreover, prostaglandins normally repair small ulcers that form in the gut. However, the secretion of glucocorticoids in response to stress leads to a decrease in prostaglandin synthesis and loss of this repair ability.

In addition to the direct consequences of stress on gastric acid secretion, behavioral changes in smoking, drinking, or dietary habits that may occur in response to being under stress may also play a role in the effect of stress on peptic ulcer formation.

### Reproductive System

Stress affects sexual function and fertility in both males and females. This effect is exerted primarily through a chain of events that leads to a decrease in testosterone formation in males and estrogen in females. In addition, erections in males are caused by the parasympathetic nervous system. The decreased parasympathetic nervous system activation during stress leads to sexual dysfunction such as difficult erections, impotence and premature ejaculation.

In females, the drop in reproductive hormone levels leads to loss of libido (sexual drive), irregular menstrual cycles, and in severe cases to anovulatory amenorrhea (cessation of ovulation and menstruation). Stress affects fertility in females through an increase in prolactin secretion, which interferes with progesterone activity and thus disrupts the maturation of the uterine wall and decreases the likelihood of implantation of a fertilized ovum. Moreover, the success of assisted reproductive techniques (e.g., in vitro fertilization) may also be affected by stress. It has been suggested that the rates of conception after in

vitro fertilization are affected by psychological distress during the treatment cycle. Although rare, stress-induced abortion may also occur.

The increased sympathetic nervous system activation during stress causes an increase in epinephrine and norepinephrine release, and the result is a drop in blood flow through the uterus. This leads to a drop in blood pressure and heart rate in the fetus. If this scenario is repeated frequently, fetal death may occur due to hypoxia. Stress during pregnancy has also been linked to preterm birth and lower birth weight. After delivery, psychological stress may interfere with lactation. This occurs either through a decrease in milk synthesis or ejection due to stress-related inhibition of prolactin or oxytocin release or an increase in sympathetic nervous system activity.

### Growth

In older adults, the increased glucocorticoids secretion that occurs in response to stress leads to a triad that increases the risk of osteoporosis. This triad consists of a blockage of the uptake of dietary calcium in the intestines, an increased excretion of calcium by the kidney, and acceleration of bone resorption.

In children, a rare condition termed *stress dwarfism* occurs due to severe emotional neglect or psychological abuse. Psychological stress in these children leads to a marked increase in glucocorticoids, which both blocks the secretion of growth hormone and decreases the sensitivity of the target cells to growth hormone. The elevated glucocorticoids also affect bone growth through the triad described above. The stunted growth in these children resumes upon removal of the stressor.

### INDIVIDUAL VARIABILITY IN THE STRESS RESPONSE

Establishing the role of the mind in disease is complicated by the fact that cause-effect relationships are very hard to establish. The differences in individual responses to stress complicate this matter further. Interindividual variability in response to stress is determined by many factors including age, ethnicity, gender, coping style, psychological factors, and genetic factors, to name a few. In our modern society, stress-related diseases are on the rise. Behavioral research bears the task of continuing research on the relationship between mind and body and the subsequent effects on human health and disease.

## BEHAVIORAL STRESS MANAGEMENT TECHNIQUES

On a more positive note, our responses to stress are not completely preset and out of our control. Stress management techniques teach individuals how to prevent, reduce, and cope with stress. Examples of such techniques are relaxation, hypnosis, cognitive restructuring, visualization, disclosure, conditioning, assertiveness training, biofeedback, and meditation. Stress management has been found to be successful in preventing the development of and reducing already established disease. In myocardial infarction patients, stress management was found to improve the quality of life and reduce morbidity. It has also been found to decrease blood pressure in patients with hypertension. In HIV disease, stress management training buffered illness-related psychological distress. In cancer patients, stress management intervention was found to influence immune responses of patients as well as the course of their illness.

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See also ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
ASTHMA AND STRESS; BLOOD PRESSURE, HYPERTENSION,  
AND STRESS; CARDIOVASCULAR PSYCHOPHYSIOLOGY;  
MEASURES; CARDIOVASCULAR REACTIVITY; GASTRIC  
ULCERS AND STRESS; METABOLIC SYNDROME AND STRESS;  
PEPTIC ULCERS AND STRESS; PSYCHONEUROIMMUNOLOGY;  
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HEALING AND STRESS

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## STRESS-BUFFERING HYPOTHESIS

Acute or chronic stressful experiences such as illness, life events, and developmental transitions often impose demands that we are unable to address. Such

experiences are thought to put people at risk for psychological and physical disease and disorder. The provision or exchange of emotional, informational, or instrumental resources in response to others' needs is thought to facilitate coping with these demands and consequently be protective. This proposal is called the stress-buffering hypothesis—social resources (supports) will ameliorate the potentially pathogenic effects of stressful events. Although aid can be provided by professionals or in the context of formal “helping” groups, this entry focuses on support provided in informal relationships.

The stress-buffering hypothesis was formally proposed in 1976 by physician and epidemiologist John Cassel and psychiatrist Sidney Cobb. Both argued that those with strong social ties were protected from the potential pathogenic effects of stressful events. Cassel (1976) thought that stressors that placed persons at risk for disease were often characterized by confusing or absent feedback from the social environment. In contrast, the impact of the stressors was mitigated among individuals whose networks provided them with consistent communication of what is expected of them, assistance with tasks, evaluation of their performance, and appropriate rewards (Cassel, 1976). Similarly, Cobb (1976) thought that major life transitions and crises placed people at risk. He argued that those who interpreted communications from others signifying that they were cared for and valued and that they belonged to a network of mutual obligation were protected. He thought that this protection occurred because these perceptions facilitated coping and adaptation (see more recent discussion by Lakey & Cohen, 2000; Thoits, 1986).

Correlational studies testing the stress-buffering hypothesis have generally been supportive. Although this literature has primarily focused on psychological distress as an outcome (see Cohen & Wills, 1985; Schwartz & Leppin, 1989), there are a few studies focusing on physical disease outcomes as well (e.g., Rosengren, Orth-Gomer, Wedel, & Wilhelmsen, 1993). Overall, work on stress-buffering indicates the importance of the “perceived availability” of support (e.g., Wethington & Kessler, 1986). In contrast, actually receiving support has often been correlated with negative outcomes, presumably because actual receipt indicates the need for support as well as its availability.

Research also suggests that the most effective support is not asked for, but is instead provided in the course of everyday social transactions (Barerra,

Sandler, & Ramsay, 1981; Eckenrode & Wethington, 1990; Pearlin & Scholler, 1978). We do not generally think of support provided by close friends and relatives as help and often are unaware of receiving it (Bolger, Zuckerman, & Kessler, 2000). Actually asking for help is a more complicated issue with the request raising issues of equity and relationship maintenance and quality (Fisher, Nadler, & Whitcher-Alagna, 1982). The idea is that our close relations should know we can use their support and respond without the need for a formal request for help.

How does social support provide protection from stressful events? Support may play a role at several points in the causal chain linking stress to health (Cohen, Gottlieb, & Underwood, 2000; Gore, 1981; House, 1981). First, support may intervene between the stressful event and a stress reaction by attenuating or preventing a stress appraisal. More specifically, the perception that others can and will provide resources may redefine the harm potential of a situation and bolster one's perceived ability to cope with imposed demands, thereby preventing a situation from being appraised as highly stressful (Thoits, 1986). Second, support beliefs may reduce or eliminate the affective reaction to a stressful event, dampen physiological responses to the event, or prevent or alter maladaptive behavioral responses. The availability of persons to talk to about problems has also been found to reduce the intrusive thoughts that act to maintain chronic maladaptive responses to stressful events (Lepore, Silver, Wortman, & Wayment, 1996). Finally, support may intervene by reducing the stress reaction or by directly influencing physiological processes. Support may alleviate the impact of stress by providing a solution to the problem, by reducing the perceived importance of the problem, or by providing a distraction from the problem. It may also tranquilize the neuroendocrine system so that people are less stress reactive, or facilitate health-promoting behaviors such as exercise, proper nutrition, and rest (cf. Cohen & Wills, 1985; House, 1981).

Several different types of support have been delineated, and it is posited that these functions may be differentially useful for a range of stressors (Cohen & McKay, 1984; Cohen & Wills, 1985; Cutrona & Russell, 1990; Sandler, Miller, Short, & Wolchik, 1989). There are several typologies of support, but most include components of emotional (being cared for and valued), informational (information about the stressful events and coping with them), and material aid. The stress-support matching hypothesis (Cohen &

McKay, 1984; Cutrona & Russell, 1990) suggests that the potential benefit of a support type depends on which function will be most effective for a particular type of stressful event. Interestingly, evidence suggests that emotional support provides protection in the face of a wide range of stressful events, while other types of support seem to respond more specifically to specific needs elicited by stressful events (Cohen & Wills, 1985).

Consistent evidence is found for the buffering hypothesis when one ensures that certain methodological constraints are met (Cohen & Wills, 1985; Schwarzer & Leppin, 1989). For example, it is important that the study have a large sample size, a reasonable distribution of stress and support values, measures with acceptable psychometric properties, and nonconfounded stress and support measures. As mentioned earlier, effects are most consistently found with measures of perceived availability of support, especially emotional support.

A second relevant literature is the study of the effectiveness of social support interventions for helping people in the face of stressful events (Cohen et al., 2000). Collectively, these group and dyadic interventions are impressive because they reveal the many ways in which it may be possible to engineer support on behalf of people in highly diverse stressful circumstances. However, to date, there is more evidence on the feasibility of marshaling support than of its effectiveness. For example, two reviews of the outcomes of support groups for family caregivers of elderly persons paint a bleak picture with respect to the attainment of desired goals (Lavoie, 1995; Toseland & Rossiter, 1989). The same is true in the context of support groups for cancer patients (Fawzy et al., 1990; Helgeson & Cohen, 1996). The authors of these reviews provide reasonable explanations for the lack of clear evidence that we can help people under stress by providing support. Nevertheless, we have not as yet been able to translate the studies of support in naturalistic settings to effective artificial interventions.

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**STRESS AND HEALTH. See AIDS AND HIV; STRESS; ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS; BLOOD PRESSURE, HYPERTENSION, AND STRESS; CARDIOVASCULAR REACTIVITY; CAREGIVING AND STRESS; CHILD ABUSE, CHILD NEGLECT, AND HEALTH; DISASTERS AND HEALTH; EMOTIONS: NEGATIVE EMOTIONS AND HEALTH; ENDOGENOUS OPIOIDS, STRESS, AND HEALTH; GASTRIC ULCERS AND STRESS;**

**IMMUNE RESPONSES TO STRESS; JOB STRAIN AND HEALTH; JOHN HENRYISM AND HEALTH; LOW BIRTH WEIGHT: PSYCHOSOCIAL ASPECTS; METABOLIC SYNDROME AND STRESS; PEPTIC ULCERS AND STRESS; STRESS, APPRAISAL, AND COPING; STRESS: BIOLOGICAL ASPECTS; STRESS-BUFFERING HYPOTHESIS; STRESS-RELATED GROWTH; WOUND HEALING AND STRESS**

## **STRESS MANAGEMENT.**

**See ARTHRITIS: BEHAVIORAL TREATMENT; ASTHMA: BEHAVIORAL TREATMENT; BIOFEEDBACK; CANCER: PSYCHOSOCIAL TREATMENT; CHRONIC OBSTRUCTIVE PULMONARY DISEASE: PSYCHOSOCIAL ASPECTS AND BEHAVIORAL TREATMENTS; CHRONIC PAIN MANAGEMENT; DIABETES: BEHAVIORAL TREATMENT; HEADACHES: PSYCHOLOGICAL MANAGEMENT; IRRITABLE BOWEL SYNDROME: PSYCHOLOGICAL TREATMENT; SLEEP DISORDERS: BEHAVIORAL TREATMENT**

## **STRESS-RELATED GROWTH**

Stress-related growth refers to the positive changes that people report experiencing following stressful or traumatic life experiences. These positive changes are attributed to the stressful encounter and are made in response to it or arise from efforts to cope with it. While not everyone experiences stress-related growth, it is a very common outcome following stressful experiences. Stress-related growth has been documented after encounters with bereavement, combat, natural disasters, terrorist attacks, and life-threatening health crises such as HIV infection, myocardial infarction, and cancer. Stress-related growth can also occur following less severe stressors, such as developmental transitions (e.g., leaving home for college, romantic breakup).

It is important to note that experiencing stress-related growth does not mean that people did not suffer

or experience adverse consequences as a result of the stressful situation, but seems to be a separate outcome of stressful encounters. Research studies sometimes refer to stress-related growth as “perceived benefits” or “thriving.”

## **TYPES OF STRESS-RELATED GROWTH**

Many different kinds of stress-related growth have been reported; these can be categorized in four domains: competencies, life philosophies, relationships with others, and lifestyle changes. Stress-related growth in competencies can involve increased confidence, coping skills, and knowledge. Stress-related growth in life philosophies can include increased awareness and insight as well as changes in one’s life meaning and spirituality and a reordering of life values, goals, and priorities. Social stress-related growth includes positive changes in social relationships, such as deepened bonds with others, a widened social network, and improved communication. Stress-related growth can also involve making changes toward a healthier lifestyle, such as decreasing alcohol and drug use, quitting smoking, starting a new exercise program, and reducing stress.

## **THEORIES OF HOW STRESS-RELATED GROWTH OCCURS**

Stress-related growth can occur suddenly, but usually occurs over time and is related to the ways that individuals respond to their stressful encounters. Stress-related growth is more likely to occur when experiences are highly stressful, because these experiences cause more disruption of individuals’ beliefs and goals and require more coping efforts and change. Stress-related growth appears to arise through people’s efforts to restore their beliefs and to bring their perceptions of aversive situations more in line with their goals. For example, a stressful encounter such as the untimely death of a loved one might disrupt an individual’s sense that the world is a fair or just place and his or her own sense of invulnerability as well as making some goals unattainable. Over time, individuals are likely to recognize some positive aspects of the loss and the lessons that they learned through coping with it, even though the loss itself may remain quite painful.



Certain types of coping with stressful situations are related to higher levels of stress-related growth. Attempting to actively resolve the problem and to create meaning from it are particularly likely to lead to stress-related growth. Meaning can be made by talking about the situation with others and spending time thinking about it and its implications for one's life. Stress-related growth is a typical outcome of this meaning making, involving identifying the positive changes that have occurred internally, making positive changes in one's social relationships and lifestyle, or even making changes in life goals such as devoting one's energies to a larger social cause. Stress-related growth usually develops as a natural part of the coping process, but it can be facilitated by psychotherapy.

Individuals who are more religious or spiritual, more optimistic, and more extraverted, and who have more social support resources, are more likely to experience stress-related growth. Some studies show that women report higher levels of stress-related growth than men do.

#### RELATIONSHIP OF STRESS-RELATED GROWTH TO HEALTH AND WELL-BEING

Stress-related growth is often related to better physical health and psychological well-being following stressful experiences. In terms of psychological well-being, it appears that stress-related growth is often, but not always, related to better psychological adjustment following the stressful experience, such as less depressed mood and higher life satisfaction. The very fact that people believe that they have grown is also sometimes considered to reflect increased well-being.

Stress-related growth often occurs in the context of physical health crises. Those crises that are life-threatening, in particular, appear to create the type of distressing situation that leads people to reconsider their lives, reevaluate their situations, and search for meaning. Many people institute positive changes in their lives following these crises in all of the domains listed above. For example, heart attack patients sometimes make dramatic changes in their lifestyle as part of their growth, in response to their near-death experience and their renewed sense of life's fragility and need for better care. Stress-related growth is also commonly found in those with chronic illnesses, such as rheumatoid arthritis.

In addition to commonly occurring in the context of serious illness and commonly relating to better psychological adjustment to these illnesses, stress-related

growth appears to at least sometimes be related to the physical health of individuals dealing with health crises. For example, a study of heart attack patients who shortly after their hospitalization reported experiencing stress-related growth were more likely to be alive and less likely to have had a recurrence of heart attack 7 years later, and a study of HIV-positive men found that stress-related growth was related to better immune functioning (CD4 levels), even after taking into account all known physiological indicators.

—Crystal L. Park

See also *STRESS, APPRAISAL, AND COPING*

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## SUCCESSFUL AGING

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Successful aging is a relatively new construct, growing out of the recognition that there are individual differences in both the rate and the manner in which individuals age. Some individuals in their 60s and 70s can run marathons and are cognitively sharp, while others in midlife are coping with disabling chronic illnesses such as diabetes and may be suffering the beginnings of cognitive decline. Similarly, some individuals are happy and enjoy good relations with family and friends, while others are isolated and lonely. Given that the study of successful aging is relatively new, there are as yet no fixed definitions,

although there are different models in the literature. This entry reviews these models as well as the predictors of successful aging.

## MODELS OF SUCCESSFUL AGING

Rowe and Kahn (1998) have proposed the most widely accepted model. Their three components of successful aging include the absence of disease, good cognitive and physical functioning, and an active engagement with life, which is characterized by good social relations and productive behavior. The model is hierarchical in that it assumes that these three components build on each other. That is, the absence of disease is the basis of good cognitive and physical functioning, which, in turn, can promote an active engagement with life.

Vaillant's (2002) model is similar, but has six criteria rather than three. Three of the criteria concern physical health: absence of any physician-diagnosed chronic illness by age 75, good self-rated health including no problems with instrumental activities of daily living (IADLs), and the length of undisabled life. The other three criteria are good mental health, good social support (including religious attendance), and satisfaction with life in a variety of different domains.

While intuitively appealing, these models have been criticized as simply extending the criteria for good midlife functioning to late life, and may be too stringent. Most individuals who live to very late life will develop chronic illness at some point, and many still consider themselves to be successfully aging. Perhaps successful aging is simply doing the best one can with whatever resources and vulnerabilities one has; the term *optimal aging* reflects this more pragmatic viewpoint.

These models of successful aging also may neglect special characteristics of old age. Tornstam (1994) observed that the old-old individuals, over the age of 80, exhibited something he called "gerotranscendence," which is characterized by a lessening reliance on external definitions of the self; a quiet, more contemplative attitude; and an enhanced perspective on the interconnectedness of life. This "Zen-like" state, as well as an increase in spirituality in very late life, has been also noted by Vaillant. Snowden (2001) observed that older adults with sometimes very grave disabilities could draw on their sense of spirituality to maintain their emotional equilibrium and contribute what they could to their communities. Thus, the development of wisdom may be a marker for successful aging, even in those individuals with physical disabilities.

## PREDICTORS OF SUCCESSFUL AGING

While genetics plays some role in the development of illness and disability in late life, maintenance of good health largely depends on lifestyle options we have and the choices that we make. A balanced diet, moderate exercise, and avoiding toxins such as cigarettes help to maintain cardiovascular health and avoid diseases such as diabetes that accelerate the aging process. Cardiovascular health may also be the key to maintaining good cognitive functioning, and cognitive exercises such as reading, doing puzzles, or being active in volunteer or professional work may also contribute to cognitive health.

Supportive social relations may be key to maintaining good mental health in late life. However, social losses increase with age, and older adults may be at heightened risk for depression. Older adults may have outlived spouses, siblings, friends, and even children, and disabilities may be accompanied by chronic pain and social isolation, if sensory or mobility problems make it difficult to socialize. Although the size of social networks may decrease with age, most older adults have strong ties with a few close family and friends. Volunteer work may help older adults to feel that they are productive members of their community, and religiousness or spirituality may also protect against depression in late life.

Personality and coping resources may also play an important role in successful aging. Individuals high in emotional stability may show little increase in symptoms with age, while those high in anxiety and hostility may develop chronic illnesses earlier. Vaillant found that good coping strategies or "mature defenses" were among the best predictors of successful aging. This includes the use of altruism, sublimation, suppression, and humor to cope with problems. Perhaps the ability to transform stressors into opportunities for growth may make it possible to age successfully, despite the disabilities and losses that may accompany old age.

—Carolyn M. Aldwin

See also SELF-EFFICACY; SELF-REPORTED HEALTH; SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH; STRESS, APPRAISAL, AND COPING

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## SUPPORT GROUPS AND HEALTH

Support groups consist of small groups of individuals who meet, usually on a regular basis, to discuss mutual problems. The most common reason for participation in a support group is for help in coping with a physical illness. Over the past two decades, the availability of support groups has grown exponentially. Support groups have been found to have both mental and physical health benefits. Increasingly, support groups are being viewed as an important adjunct to the care of the medically ill and their loved ones.

### WHAT IS A SUPPORT GROUP?

A support group usually consists of individuals who have the same type of illness (or have some other stressor in common, such as bereavement) or it might consist of the family members, close friends, or caregivers of these individuals. A support group provides a setting where individuals can share their experiences with others who are coping with the same stressor. Support groups vary in size, but a typical support group ranges from 6 to 12 members.

As the name suggests, the main purpose of a support group is to provide support to the group members. There are three types of support that a group might provide: emotional, informational, and instrumental. Providing emotional support is perhaps a support group's defining feature. Participants are encouraged to express their emotions and concerns and to give as well as receive support from individuals who are facing similar circumstances. The

assumption is that benefit occurs from expressing emotions and sharing concerns with individuals in similar situations as well as from receiving their concern, understanding, and caring. It also appears that members can receive as much benefit from providing support to others as they do from receiving it. This has been referred to as the helper-therapy principle.

Some support groups provide information and education about the illness either formally or informally. A support group might be structured such that a portion of time is allotted for the group leader or an outside expert to provide education or information. In an unstructured group format, either the group leaders or the members might provide informal education or information.

Instrumental support is when group members carry out practical activities to help one another, such as assisting with child care, running errands, or preparing a meal for a group member in need. This type of support may or may not occur and if it does occur it will take place outside of the support group meeting.

### CHARACTERISTICS OF SUPPORT GROUPS

#### Target Population

Support groups can be formed for any type of illness, such as cancer, multiple sclerosis, alcoholism, and so on. Support groups can be formed for the caregivers of those who are ill, such as family members or other loved ones. They can be formed for individuals who have lost a loved one, or who are the victims of some adverse event such as childhood sexual abuse.

The target population can be either broadly or narrowly defined. Take cancer as an example. There are many different kinds of cancer, and there are different stages of the illness. Thus, one group might narrowly target women recently diagnosed with primary breast cancer. Another group might enlist a broader range of individuals including people of either gender who have lung cancer and at any stage of the illness. Or a group might include individuals with all types of cancer and any stage of the illness.

It is often most beneficial to include people whose illnesses are as similar as possible. The advantage is that they will have many experiences in common, which can lead to greater understanding and support. It is not always possible to have homogeneous groups especially in small communities or with rare illnesses. Even if the support group is not homogeneous to the type and stage of illness, the benefits of a heterogeneous group often far outweigh the disadvantages.

One advantage of a heterogeneous group is that it can provide a range of experiences and perspectives.

There are some circumstances in which it is not appropriate to have an individual join a support group. For example, individuals who are in crisis may need more than a group can offer, especially when the stressor is not related to the focus of the group. Sometimes it is possible to have such individuals receive individual therapy to help them manage the crisis. In that case, it might then be possible for them to effectively participate in a support group. Naturally, illness-related crises will occur in the life of a group. These types of crises are to be expected and dealing with them in group should be considered an important group task. The main consideration regarding crises is whether focusing on that person's crisis will derail the focus on the group because it is protracted (i.e., taking up extensive time over several sessions) and off-topic. Other contraindications for support groups include individuals who are hostile, antisocial, psychotic, unmotivated, cognitively impaired, or acutely suicidal.

### Leadership

Support groups can be either peer led or professionally led. Leaders of peer-led groups usually have first-hand experience with the focus of that group. For example, a bereaved parent might facilitate a group for bereaved parents or a former breast cancer patient might lead a breast cancer support group. Peer-led groups are also called self-help groups. However, many so-called self-help groups are actually professionally led. Some professionally led groups may describe their group as self-help to emphasize their viewpoint that it is what the members get from each other that is most beneficial. Professionally led groups are facilitated by social workers, psychologists, psychiatrists, or other trained mental health professionals. The focus of these support groups is often greatly influenced by the facilitators. In peer-led groups, the focus is likely to be determined primarily by the group members. In professionally led groups, the facilitator may steer the group members toward focusing on emotional and psychological issues. In peer-led groups, the members might focus more on sharing information with one another.

### Group Format and Structure

A support group might be open (allowing members to come and go as they desire), closed (where members are preselected and new members are not allowed

to join), time limited (where the group has a predetermined number of sessions), or open-ended (where the group meets for an indefinite number of sessions). Typically, time-limited groups are also closed groups. Open-ended groups may be either open to members joining at any time or closed to new members but allowing new members to join as old members leave.

Before the advent of the Internet, support groups were almost universally face-to-face. In recent years, there has been a proliferation of Internet support groups. For those who have access to the Internet, online support groups offer a convenient means for participation. Online groups can be either synchronous (chat rooms) or asynchronous (bulletin boards), peer led or professionally led, open or closed, and time limited or open-ended.

A support group should allow time for mutual sharing. Some support groups consist entirely of mutual sharing. In such groups, the emphasis is on having members share their experiences and concerns, express emotions, and receive and offer emotional support and also can include the sharing of information. Sometimes support groups are more structured, offering education about the illness and teaching coping strategies, with less time allotted for mutual sharing.

### MENTAL HEALTH BENEFITS OF SUPPORT GROUPS

There are many mental health benefits of participating in a support group. One key benefit is that participants feel less isolated. Feelings of isolation can occur for a variety of reasons. This can include feeling as though other people do not understand, feeling stigmatized, looking different from others, believing people are afraid of them or blame them for their illness, being too ill to maintain social activities, and so on. It has been shown that people seek social support for help in dealing with illnesses that are embarrassing, stigmatizing, or disfiguring and for dealing with the threat of death or costly medical treatment. Research has shown that reassurance or empathy from family or friends is not necessarily helpful because it can be experienced as an attempt to minimize their problem. However, similar responses from people who are in their situation can be experienced as highly supportive. Participating in a support group likely alleviates feelings of isolation by virtue of being with a group of people who both understand and share their experiences and concerns.

Support groups provide an opportunity for members to speak freely about their situation. It is not uncommon for people who are seriously ill or otherwise distressed to avoid talking about their distress with their loved ones. Often this is done so as to protect them. For example, seriously ill patients may avoid talking about their fears of dying because they do not want to upset their family. Furthermore, they may have concerns or issues with their family that they may not feel free to discuss with them. Ideally, a support group provides a venue where members can speak about all of their feelings and concerns without having to worry about protecting the other.

Another benefit of support groups is that group members learn from each other, either explicitly or implicitly. Members might tell each other about coping strategies that have worked for them or share information about treatment and treatment options. Group members gain hope by seeing how well others cope or by seeing members with a similar prognosis do better than expected. Members offer each other advice, encouragement, and support. They also serve as role models for each other, modeling both adaptive and sometimes less adaptive ways of coping. Learning active coping strategies is a common benefit of participating in a support group.

Learning more adaptive coping strategies can lead to an increase in self-efficacy—the belief in one's ability to handle new situations. This is especially important for individuals recently diagnosed with a medical illness. For instance, a group member might learn more adaptive strategies for dealing with a doctor and as a result feel better equipped to deal with his or her doctor in the future.

In general, research has shown that support groups can improve emotional adjustment, including general mood, depression, and anxiety. However, a meta-analysis of psychosocial interventions for cancer patients suggests that the benefits may vary depending on who leads the support group. Professionally led support groups have been shown to improve emotional and functional adjustment; whereas peer-led support groups have had more mixed results. However, research examining the benefits of peer-led groups is limited and more is needed before definitive conclusions are drawn.

## EFFECTS OF SUPPORT GROUPS ON PHYSICAL HEALTH

There is evidence that support groups can positively affect physical health. Professionally led support groups have been found to reduce pain and enhance the response of the immune system, and there is some evidence that they may even prolong life. Increased survival has been demonstrated for breast cancer, malignant melanoma, and heart disease. However, not all studies have shown this benefit and consequently more research is needed to answer this question.

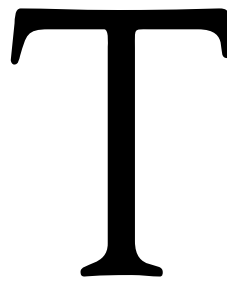
Research is also needed to examine the underlying mechanisms that may lead to a health benefit. One possibility is that support groups improve health behavior. For instance, increases in self-efficacy have been shown to positively affect health behavior. Another possibility is that support groups might lead to better treatment compliance. A third potential mediator is that support groups influence biological pathways of disease progression. Recent research on the stress hormone, cortisol, has found that it is positively affected by support groups and that there is a relationship between a dysregulation of cortisol and mortality. However, more research is needed to address this and related questions.

—Catherine Classen

See also SOCIAL INTEGRATION, SOCIAL NETWORKS, AND HEALTH

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## TAILORED COMMUNICATIONS

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As used most often in current intervention research, *tailoring* denotes the strategy of providing materials, messages, and/or activities that are matched to characteristics of each individual participant (Kreuter, Farrell, Olevitch, & Brennan, 2000; Kreuter, Strecher, & Glassman, 1999; Rimer & Glassman, 1998). In effect, each individual receives a different version of intervention content. The individual-level specificity of tailoring is often contrasted with “one size fits all” strategies in which all participants (presumably from a diverse population) receive the same intervention. Tailoring is also distinguished from the approaches of “targeting” and “personalization.” With targeting, broadly defined subgroups are identified and each gets a different intervention, but all members of a subgroup receive the same intervention. Tailoring can then be directed to the individuals within a targeted group, using an additional set of variables. With personalization, intervention materials are labeled with the participant’s name and perhaps other standard demographic identifiers to create the impression of addressing the participant individually, but it is primarily for image rather than changing the content itself.

The term *tailored communications* therefore refers to the channels and formats by which individualized information is delivered to intervention participants. A wide variety of options exist, used alone or in combination, including traditional print formats such as brochures, booklets, reminders, and tip sheets; person-to-person contacts such as telephone counselors, health care providers, and lay/peer advisers; and interactive technology-based strategies including kiosks,

CDs, Web-based programs, handheld devices, and television. There are no prescribed best methods or formats for delivering tailored communications. The core requirement is flexibility to allow individualizing the messages based on selected characteristics of each member of the target population. Tailored communication therefore also assumes that some interaction occurs between the participant and the delivery channel/agent, to obtain/provide the information needed for tailoring. Given the requirements for interaction and individualization, some delivery methods are less amenable to tailoring, such as billboards, public service announcements, and mass media campaigns. Such strategies may be better used to target messages to groups within the total audience.

The technology for delivering tailored communications to large numbers of people is relatively recent and closely tied to the evolution of computers and information-management capacity. The basic principle of individualized intervention has been long known and well accepted in health promotion/health education. However, the feasibility of implementing an individualized intervention has been subject to concerns about the time requirements placed on staff, the capacity to perform the necessary assessments, the ability to have presence in participants’ daily lives, and the ability to achieve consistent intervention delivery across multiple project staff and settings. Computer-based production of health communications offers the promise of addressing these concerns, with the additional benefit of allocating intervention resources efficiently by providing intervention messages/materials/activities only where there is apparent need.

At the core of tailored communications are algorithms (decision rules) that take an individual’s data

on a set of predefined variables (e.g., from a questionnaire, interview, or medical record) and produce a classification on each variable (e.g., high/middle/low; in quartiles; above or below a dichotomous cutpoint). The classification individuals receive on a variable in turn determines which version of a tailored communication they are given, drawn from a comprehensive “inventory” or “library” established by the interventionists. The messages for each person are then combined into the final intervention package that may also have some targeted content for their specific population subgroup. Therefore, the production of tailored communications requires the *a priori* specification of the variables that will be used, the cutpoints on each of those variables to create the discrete classifications, the messages that correspond to each classification for each variable, and the format in which a communication will be delivered (if an intervention is multimodal). Strictly speaking, it is not necessary to reduce continuous variables to discrete categories, but using the complete range of values on a continuous variable can present a substantial challenge for message construction because every value must have a corresponding message. The potential of tailoring rests heavily on its ability to respond to a wide range of combinations of personal characteristics. It is therefore common for tailored interventions to highlight their ability to individualize by calculating the total number of possible message combinations. For example, a project might tailor with nine variables, each of which is classified into four levels. On the assumption that a person’s status on these variables are potentially independent, then the tailoring can accommodate  $4^9$  or 262,144 combinations (i.e., four levels for each of nine variables). Fundamentally, this is the same logic that underlies having more complex automobile license plates in a state like California, as opposed to a lower-population state like Rhode Island.

Tailoring has a strong empirical grounding and is an application of evidence-based health education. The variables used for algorithm decision rules, and the cutpoints that define the classifications for those variables, should be based on analyses showing statistically significant associations with the target health practice. The creation of tailored communications is therefore closely tied to research that identifies correlates (but preferably predictors) of the health practice being considered. Tailored communications by nature also require knowing the larger context within which the health practice will occur. Being able to specify

that context, described as the “focal point” for the intervention (Rakowski, 1999; Rakowski & Clark, 2002), is comprised by the target population, the health practice, the intervention setting, and the performance setting, and informs selecting the variables to be examined as potential correlates. The variables that are used in the algorithm, and the conceptual model(s) that guide their use, have been referred to as the “deep knowledge” of the tailored intervention (Velicer et al., 1993). Furthermore, the empirical foundation of tailoring is presumed to be most reliable when it is based on longitudinal predictive analyses, in contrast to cross-sectional correlational analyses. Even with longitudinal analyses, however, the usefulness of a variable for tailoring depends on the plausibility of the presumed causal linkage between that variable and the health practice.

Tailoring is developing its own specialized terminology. Communications can be “normative” or “ipsative” (Dijkstra & De Vries, 1999; Prochaska, DiClemente, Velicer, & Rossi, 1993). A normative communication compares the individual against a reference group; an ipsative communication compares the individual to their own status at a previous time. Interventions are often assembled by an “expert system” (Velicer et al., 1993), which is the collection of programming code that takes the raw data of input and produces the final tailored product. In addition, the steps of preparing tailored communications can involve a “tailoring matrix,” “message concept booklets,” “message blocks,” “macro-tailoring,” and “micro-tailoring” (Dijkstra & De Vries, 1999; Kreuter et al., 2000). For example, a tailored print communication might be provided as a unit of text, such as a four-sentence paragraph, whose content would differ across the levels of a tailoring variable (macro-tailoring). Tailoring may also be done even further at the level of phrases or words in sentences, within the paragraph for a given level of that variable (micro-tailoring). Similarly, tailoring matrices and message concept booklets are the practical aids used to help keep track of the potential complexity of the tailored intervention, and plan the content of the messages and materials.

Although tailoring is generally viewed as occurring at the level of the individual, there can be a gray area. An exchange of commentaries (Kreuter & Skinner, 2000; Pasick, 2001; Rimer, 2001) involved the concept of “cultural tailoring” and whether tailoring can also occur at a group level. The different opinions expressed in these commentaries are an understandable

reflection of the interface between an emerging technology that nonetheless uses existing words as its labels (targeting, tailoring, individualizing) and research programs that may have different disciplinary bases. The hallmark of tailoring is precision, relative to the unit of intervention that is typically studied by an investigator.

Psychologically based interventions typically emphasize the individual level; other disciplines address groups as the unit. At the writing of this entry, psychologically oriented variables and principles have a strong presence in the literature of behavioral science generally, and tailoring in particular. The tailoring objective of individualized communications is very consistent with psychological perspectives about the bases of personal health practices. However, interventionists who have traditionally emphasized cultural and group-level influences on health practices might interpret "tailoring" and "individualization" to happen by precisely defining the group(s) with which they work (e.g., racial/ethnic groups, families, classrooms). For example, relative to the very wide diversity of cultural groups that exist, an intervention for a group defined by several variables that distinguished its members from the majority population might be considered tailored for that group in contrast to a "one size fits all" approach of intervening similarly with each cultural group.

It is important not to attribute a priori superiority to tailored versus targeted communications. The variables used in one investigation to define a subgroup for a targeted intervention might be used as the bases for tailoring individualized communications in another investigation. Also, a very precisely targeted intervention may produce better outcomes than a tailored intervention that generates individualized communications but is incompletely conceptualized. Tailoring and targeting are both strategies for producing and delivering communications, and therefore both are also intermediate outcomes along the way to the desired behavior change. It is therefore legitimate and necessary to study whether the products of a tailoring algorithm, in their own right, meet the intended objectives of individualization.

—William Rakowski

See also CANCER PREVENTION; HEALTH COMMUNICATION;  
HEALTH LITERACY; HEALTH PROMOTION AND DISEASE  
PREVENTION; PHYSICAL ACTIVITY INTERVENTIONS

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## TELEVISION VIEWING AND HEALTH

Television's powerful influence on health and health-related behaviors has become a major health concern, particularly as television viewing has increased. The American population spends more time watching television than it spends in any other activity except sleep, work, and school, averaging more than 4 hours of television per day. Television



viewing has been associated with increased aggressive behaviors, violence, lower academic performance, poor body self-image, poor nutrition, increased risk of obesity, and increased substance use and abuse. While recognizing the complexity in determining the causes of these problems, researchers have increasingly examined the role of television, not only as contributing to these problems but as a viable solution for intervention. Both the inactivity of watching television and the content of television programs and commercials adversely affect health.

In numerous studies among children and adults, obesity prevalence is associated with daily television viewing, while in longitudinal studies, television viewing patterns predict incidence or remission of obesity. Furthermore, preschool-aged children with a television set in their bedrooms not only watch more daily hours of television but have a higher rate of obesity. Television viewing contributes to obesity by replacing more physically active behaviors that would burn more calories and promoting increased dietary energy intake from increased snacking and/or eating or in response to food advertising. It is possible to reverse some of the negative effects of television viewing. Both clinical and population-based interventions that reduced television viewing led to relative decreases in adiposity (body fatness) and lower obesity rates.

There is an inverse relationship between the amount of television viewing and the degree of physical activity. Television viewing results in a lower metabolic rate in both obese and normal weight children compared with other sedentary activities such as sewing, reading, writing, or resting. Prolonged time in front of the television has also been associated with an increased risk of Type 2 diabetes.

A significant proportion of television commercials are for foods, and most of these advertisements are for high-calorie, high-sugar, or high-fat foods of poor nutritional quality. Exposure to televised food commercials influences food preferences, promotes between-meal snacking, and contributes to increased dietary fat intake and total energy intake in both children and adults. Families that dine with the television on during meals have less nutritional dietary patterns. They consume fewer fruits, vegetables, and dairy products, drink more soda, and eat more fast-food items than families in which television viewing and eating are separate activities. In televised programs, obesity occurs far less frequently among

characters than in the general population. Furthermore, television characters rarely perform healthy behaviors, such as exercising or eating a balanced diet, yet they tend to look healthy. Consequently, television contributes to the creation of misleading impressions between the relationship of behavior and health.

According to the American Academy of Pediatrics Committee on Public Education, next to the family, television may be the most important source of information for children and a principle factor influencing their development. This is of increasing concern, considering that over 1,000 studies and reviews show that significant exposure to television violence increases the likelihood of aggressive behavior in children and desensitizes them to violence. More important, an intervention that reduced the amount of television viewing resulted in a substantial reduction in children's aggressiveness and violent actions. Although television is promoted as an educational tool, studies show that an adult mediator or teacher is required to reinforce the concepts presented and for measurable learning to occur. Learning from television is passive rather than active, and watching more than 1 to 2 hours per day of television viewing has a negative effect on children's academic performance, especially reading scores.

Television advertisements encourage the use of drugs, alcohol, and tobacco by using unrealistic associations with positively valued activities such as romance and sociability. Furthermore, behaviors such as drinking and smoking portrayed in television shows, movies, and music videos are very influential on the health-related decisions of viewers. Despite cigarette advertising being banned from television since 1969, there has been a substantial increase in the frequency of smoking by characters in movies and television. Characters portrayed on television are more likely to smoke on screen than their real-life counterparts with similar demographic characteristics.

Television viewing also compromises sexual health and may contribute to America having the highest rates of sexually transmitted diseases and pregnancy among adolescents in the Western world. Among the 14,000 sexual references, innuendoes, and behaviors portrayed on television, only 1% of these exposures dealt responsibly with human sexuality. In a U.S. study of adolescent girls, the pregnant teens, compared to the pregnant teens, watched more soap operas before becoming pregnant and were less likely to

think that their favorite soap opera characters would use birth control. Another study showed that teenagers who watch soap operas overestimated the prevalence of sexually active teenagers and extramarital affairs and underestimated the risk of contracting sexually transmitted diseases. This is not surprising, since the sexual content of soap operas has more than doubled between 1980 and 1989. Soap opera sex is 24 times more common between unmarried partners than between spouses, and birth control is almost nonexistent.

In general, the more time individuals spend viewing television, the unhealthier they seem to be. With the growth of cable and digital television, more programs will be available and television viewing is likely to increase in the coming years. Thus, the impact of television on health and health-related practices cannot be ignored. As awareness of the negative health impacts associated with television viewing increases, parents are being encouraged to monitor their children's television viewing and other media exposure. The American Academy of Pediatrics recommends that parents limit their children's television viewing to no more than 1 to 2 hours per day of high-quality shows, that children under the age of 2 be discouraged from viewing any television, and that television sets be kept out of children's bedrooms. As a way to increase awareness of the adverse effects associated with television viewing, local community programs, promoting a week without television and encouraging alternative activities, are being implemented nationwide. In addition, programs to teach media literacy to older children, adolescents, and parents are being developed to help protect against the harmful influences of television viewing. Finally, some groups have advocated for policies such as restricting advertising, especially advertising targeted at young children.

—Barbara A. Dennison and  
Kristina Laskovski

See also OBESITY: CAUSES AND CONSEQUENCES; OBESITY IN CHILDREN: PHYSICAL ACTIVITY AND NUTRITIONAL APPROACHES; OBESITY IN CHILDREN: PREVENTION; PHYSICAL ACTIVITY AND HEALTH; VIOLENCE PREVENTION

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## THEORY OF PLANNED BEHAVIOR

First proposed by Icek Ajzen in 1985, the theory of planned behavior (TPB) is today perhaps the most popular model for the prediction of social behavior. It has its foundation in Martin Fishbein and Icek Ajzen's theory of reasoned action, which was developed in response to observed lack of correspondence between general social attitudes and actual behavior. Fishbein and Ajzen formulated the principle of compatibility, which stipulates that predictive validity is only obtained when attitude and behavior are assessed at equivalent levels of generality or specificity. General attitudes toward racial or ethnic groups, policies, or institutions fail to predict specific behaviors directed at these objects because of a lack of compatibility. By turning the focus from general attitudes toward the object of a behavior to attitudes toward the behavior itself, the principle of compatibility became a cornerstone of the theories of reasoned action and planned behavior. However, the TPB goes beyond attitude to consider other influences on behavior as well.

### THE THEORETICAL MODEL

According to the theory, human social behavior is guided by three kinds of considerations: beliefs about the behavior's likely positive and negative outcomes (behavioral beliefs), beliefs about the normative expectations of others (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behavior (control beliefs). In their respective aggregates, behavioral beliefs produce a favorable or unfavorable attitude toward the behavior; normative beliefs result in perceived social pressure to perform or not to perform the behavior, or subjective norm; and control beliefs give rise to a sense of self-efficacy or perceived behavioral control. An expectancy-value formulation describes the effects of beliefs on attitudes, subjective norms, and perceptions

of behavioral control. In the case of behavioral beliefs, the evaluation of each anticipated outcome contributes to attitude in direct proportion to the person's subjective probability that the behavior produces the outcome in question. Similarly, motivation to comply with each normative referent contributes to the subjective norm in direct proportion to the person's subjective probability that the referent thinks the person should perform the behavior; and the perceived power of each control factor to impede or facilitate performance of the behavior contributes to perceived behavioral control in direct proportion to the person's subjective probability that the control factor is present.

In combination, attitude toward the behavior, subjective norm, and perceived behavioral control lead to the formation of a behavioral intention. The relative weight or importance of each determinant of intention will vary from behavior to behavior and from population to population. However, as a general rule, the more favorable the attitude and subjective norm, and the greater the perceived behavioral control, the stronger the person's intention to perform the behavior in question. Finally, people are expected to carry out their intentions when the opportunity arises.

Intention is thus assumed to be an immediate antecedent of behavior. However, successful performance of a behavior depends not only on a favorable intention but also on a sufficient level of behavioral control, that is, on the possession of requisite skills, resources, opportunities, and the presence of other supportive conditions. Because many behaviors pose difficulties of execution, the TPB also relies on perceived behavioral control in the prediction of behavior. To the extent that perceived behavioral control is veridical, it can serve as a proxy of actual control and can, together with intention, be used in the prediction of behavior.

Beliefs play a central role in the theory of planned behavior. Accessible behavioral, normative, and control beliefs—elicited in a free-response format—are assumed to determine prevailing attitudes, subjective norms, and perceptions of behavioral control, and they thus serve as the fundamental explanatory constructs in the theory. Other variables, such as personality traits, gender, education, intelligence, motivation, or values are assumed to influence behavior indirectly by their effects on underlying beliefs.

The theory of planned behavior assumes that human social behavior is reasoned or planned in the sense that it takes account of a behavior's likely

consequences, the normative expectations of important referents, and factors that may impede performance of the behavior. Although the beliefs people hold may sometimes be inaccurate, unfounded, or biased, their attitudes, subjective norms, and perceptions of behavioral control are thought to follow spontaneously and reasonably from these beliefs, produce a corresponding behavioral intention, and ultimately result in behavior that is consistent with the overall tenor of the beliefs. However, this does not necessarily presuppose a deliberate, effortful retrieval of information and construction of attitudes prior to every enactment of a behavior. After at least minimal experience with the behavior, attitude, subjective norm, and perceived behavioral control are assumed to be available automatically as performance of the behavior is contemplated.

Successful application of the TPB is predicated on two conditions. First, the measures of attitude, subjective norm, perceived behavioral control, and intention must observe the principle of compatibility, that is, they must be compatible with each other and with the measure of behavior in terms of the action involved, the target at which the action is directed, and the context and time of its enactment. Second, attitude, subjective norm, perceived behavioral control, and intention must remain relatively stable over time. Any changes in these variables prior to observation of the behavior will tend to impair their predictive validity.

## EMPIRICAL SUPPORT

The theory of planned behavior has been applied in research on a myriad of social behaviors, including investment decisions, high school dropout, mountain climbing, driving violations, recycling, class attendance, voting in elections, extramarital affairs, antinuclear activism, playing basketball, choice of travel mode, tax evasion, and a host of other activities related to protection of the environment, crime, recreation, education, politics, religion, and virtually any imaginable sphere of human endeavor. It has found its most intense application, however, in the health domain, where it has been used to predict and explain such varied behaviors as drinking, smoking, drug use, exercising, blood donation, dental care, fat consumption, breast self-examination, condom use, weight loss, infant sugar intake, getting medical checkups, physician referrals, protection of the skin from the sun, living kidney donation, and compliance with medical regimens.

The results of these investigations have, by and large, confirmed the theory's structure and predictive validity, especially when its constructs were properly operationalized. Even without this caveat, the TPB has fared very well. Meta-analytic reviews of close to 200 data sets in a variety of behavioral domains have found that the theory accounts, on average, for about 40% of the variance in intentions, with all three predictors—attitude toward the behavior, subjective norm, and perceived behavioral control—making independent contributions to the prediction, and that intentions and perceptions of behavioral control explain about 30% of the behavioral variance. Effects of similar magnitude have been documented in the domain of health and safety, where meta-analytic reviews have focused on studies of addiction, clinical screening, driving, eating, exercising, HIV/AIDS prevention, and oral hygiene.

The TPB has also served as a useful tool for analyzing the transition from one stage of behavior to another in the context of the transtheoretical stages of change model. Attitudes, subjective norms, perceptions of behavioral control, and intentions are found to increase directly with stage of change, from precontemplation through contemplation, preparation, action, and maintenance.

Given its predictive validity, the TPB can serve as a conceptual framework for interventions designed to influence intentions and behavior. Thus far, only a small number of investigators have attempted to apply the theory in this fashion. The results of these attempts have been encouraging. Interventions directed at one or more of the theory's predictors have been found to increase use of public transportation among college students and to raise the effectiveness of job search behavior of unemployed individuals. In the health domain, interventions based on the theory of planned behavior have been found effective in promoting testicular self-examination and inducing alcoholics to join a treatment program.

#### FROM INTENTIONS TO BEHAVIOR

As noted earlier, for the theory of planned behavior to afford accurate prediction, intentions must remain relatively stable. Empirical evidence supports this expectation, showing that the intention-behavior relation declines with instability in intentions over time. More important, however, the theory also assumes that people will act on their intentions under appropriate

circumstances. This expectation has frequently been challenged, beginning with R. T. LaPiere's classic study in which ready acceptance of a Chinese couple in hotels, motels, and restaurants contrasted sharply with stated intentions not to accept "members of the Chinese race" in these same establishments. Similar discrepancies have been revealed in investigations of health behavior where it is found that large proportions of participants fail to carry out their intentions to use condoms, to undergo cancer screening, to exercise, to perform breast self-examination, to take vitamin pills, to maintain a weight-loss program, and so forth.

A variety of factors may be responsible for observed failures of effective self-regulation, yet a simple intervention can often do much to reduce the gap between intended and actual behavior. When individuals are asked to formulate a specific plan—an implementation intention—indicating when, where, and how they will carry out the intended action, the correspondence between intended and actual behavior increases dramatically. Behavioral interventions that focus on implementation intentions have been shown to produce very high rates of compliance with such recommended practices as cervical cancer screening and breast self-examination.

#### CRITIQUES

Although popular and successful—or perhaps because of it—the TPB has not escaped criticism. One type of critique has challenged the unitary nature of the theory's major constructs. Thus, it has been argued that intentions are cognitive representations not only of behavioral plans but also of expectations regarding likely behavior; that attitudes contain affective as well as evaluative reactions to the behavior; that subjective norms, in addition to injunctive expectations, also subsume descriptive norms; and that perceived behavioral control includes self-efficacy as well as perceived controllability of the behavior.

A second type of criticism is directed at the theory's structure, that is, the relations among the theoretical constructs. It has been suggested that attitudes may have a direct effect on behavior, bypassing intentions, or that attitudes, subjective norms, and perceptions of behavioral control may interact with intentions to influence behavior.

Still other concerns have to do with the theory's sufficiency—the proposition that attitudes, subjective

norms, and perceptions of behavioral control are sufficient to predict intentions and behavior. Investigators have suggested a number of variables that might be added to the theory to improve its predictive validity. Among the proposed additions are desire and need; affect and anticipated regret; personal and moral norms; past behavior; and self-identity, that is, the extent to which people view themselves as the kind of person who would perform the behavior in question.

Finally, investigators have challenged the theory's reasoned action assumption or, more precisely, they have argued that reasoned action may represent only one mode of operation, the controlled or deliberate mode. According to Russell Fazio's MODE model, reasoned action occurs when people are motivated and capable of retrieving their beliefs, attitudes, and intentions in an effortful manner. When they lack motivation or cognitive capacity to do so, they are said to operate in the spontaneous mode where attitudes must be strong enough to be activated automatically if they are to guide behavior.

An alternative critique of the TPB's reasoned action assumption relies on the well-known phenomenon that, with repeated performance, behavior becomes routine and no longer requires much conscious control for its execution. Some have suggested that as a result of this process of habituation, initiation of the behavior becomes automatic and control over the behavior is transferred from conscious intentions to critical stimulus cues. The finding that frequency of past behavior is often a good predictor of later behavior and, indeed, that it has a residual impact on later behavior over and above the influence of intention and perceived behavior control has been taken as evidence for automaticity in social behavior.

—Icek Ajzen

See also THEORY OF REASONED ACTION; THEORY OF TRIADIC INFLUENCE; TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

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## THEORY OF REASONED ACTION

The theory of reasoned action (TRA) is a general theory of behavior that was developed largely in response to the repeated failure of traditional attitude measures to predict specific behaviors. First introduced in 1967 by Martin Fishbein, the theory was further developed by Fishbein and Icek Ajzen (see, e.g., Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980). In an atmosphere where it was assumed that behavioral prediction was difficult (if not impossible), the theory began with the premise that behavior could be predicted simply by asking a person whether he or she was or was not going to perform that behavior. Not surprisingly, people turned out to be very good predictors of their own behavior. Thus, according to the theory, performance or nonperformance of a given behavior is primarily determined by the strength of a person's intention to perform (or to not perform) that behavior, where intention is defined as the subjective likelihood that one will perform (or try to perform) the behavior in question.

In addition to forming intentions to perform specific behaviors (e.g., to jog 20 minutes every day, to always use a condom for vaginal sex with my spouse), people may also form intentions to engage in behavioral categories (e.g., to exercise, to practice safe sex) and to reach certain goals (e.g., to lose weight, to stay healthy). Unlike the strong relation between intentions to engage in a given behavior and behavioral performance, however, there is no necessary relation between intentions to engage in a behavioral category and performance of any single behavior in that category or between intentions to reach a goal and goal

attainment. Thus, the TRA recognized that only intentions to engage in volitionally controlled behaviors will consistently lead to accurate behavioral predictions. Although this has been viewed as a limitation of the theory, most socially relevant behaviors are largely under volitional control.

## PREDICTING INTENTIONS

The intention (I) to perform a given behavior (B) is, in turn, viewed as a function of two basic factors: the person's attitude toward performing the behavior (i.e., one's overall positive or negative feeling about personally performing the behavior—Ab) and/or the person's subjective norm concerning his or her performance of the behavior (i.e., the person's perception that his or her important others think that he or she should or should not perform the behavior in question—SN). Algebraically, this can be expressed as:  $B \sim I = w_1Ab + w_2SN$ , where  $w_1$  and  $w_2$  are weights indicating the relative importance of attitudes and subjective norms as determinants of intention. It is important to recognize that the relative importance of these two psychosocial variables as determinants of intention will depend upon both the behavior and the population being considered. Thus, for example, one behavior may be primarily determined by attitudinal considerations, while another may be primarily influenced by perceived norms. Similarly, a behavior that is attitudinally driven in one population or culture may be normatively driven in another. While some behaviors may be entirely under attitudinal control (i.e.,  $w_2$  may be zero), others may be entirely under normative control (i.e.,  $w_1$  may be zero).

The theory also considers the determinants of attitudes and subjective norms. Based on Fishbein's earlier (1963) expectancy-value model, attitudes are viewed as a function of behavioral beliefs and their evaluative aspects. Algebraically,  $Ab = f(3b_i e_i)$ , where  $Ab$  = the attitude toward performing the behavior,  $b_i$  = belief that performing the behavior will lead to outcome "I," and  $e_i$  = the evaluation of outcome "i."

Somewhat similar to this, subjective norms are viewed as a function of normative beliefs and motivations to comply. Algebraically,  $SN = f(Nb_i Mc_i)$ , where  $SN$  = the subjective norm,  $Nb_i$  = the normative belief that referent "i" thinks one should (or should not) perform the behavior, and  $Mc_i$  = the motivation to comply, in general, with referent "i."

Generally speaking, the more one believes that performing a given behavior will lead to positive

outcomes and/or will prevent negative outcomes, the more favorable will be one's attitude toward performing that behavior. Similarly, the more one believes that specific referents (i.e., individuals or groups) think that one should (or should not) perform the behavior and the more one is motivated to comply with those referents, the stronger will be the perceived pressure (i.e., the subjective norm) to perform (or to not perform) that behavior.

It is at this level of behavioral and normative beliefs that the substantive uniqueness of each behavior comes into play. Clearly, the outcomes (or consequences) of performing one's behavior may be very different from those associated with performing some other behavior, even if the two behaviors appear quite similar. For example, the outcomes (or consequences) of always using a condom for vaginal sex with one's main partner may be very different from those associated with always using a condom for anal sex with one's main partner or for always using a condom for vaginal sex with an occasional partner. According to the theory, these behavioral and normative beliefs about the behavior in question must be identified in order to fully understand the determinants of that behavior. Although an investigator can sit in her or his office and develop measures of attitudes and subjective norms, she or he cannot tell you what a given population (or a given person) believes about performing a given behavior. Thus, one must go to members of that population to identify salient behavioral and normative beliefs. To put this somewhat differently, one must understand the behavior from the perspective of the population one is considering.

Finally, the TRA also considers the role played by more traditional demographic, economic, personality, attitudinal, and other individual difference variables (such as perceived risk or sensation seeking). According to the model, these types of variables play primarily an indirect role in influencing behavior. That is, these "background" or "distal" factors are expected to influence behavior only to the extent that they influence the behavioral or normative beliefs underlying attitudes and norms. Thus, for example, men and women may hold different beliefs about performing some behaviors but very similar beliefs with respect to others. Gender may therefore be related to some behaviors but not to others. According to the theory, although there is no necessary relation between "distal" or "background" variables and any given behavior, distal variables such as cultural and personality

differences and differences in a wide range of values should be reflected in the underlying belief structure.

## APPLYING THE MODEL

The first step in using the theory of reasoned action involves identifying the behavior (or behaviors) that one wishes to understand, predict, and/or change. Unfortunately, this is not as simple or straightforward as is often assumed. As indicated above, it is important to distinguish between behaviors, behavioral categories, and goals. Equally important, from the perspective of TRA, the definition of a behavior involves several elements: the action (enlisting, using, buying), the target (the army, condoms), and the context (after graduating high school, for vaginal sex with an occasional partner). Clearly, a change in any one of the elements changes the behavior under consideration. Thus, for example, enlisting in the army is a different behavior than enlisting in the navy (a change in target). Similarly, enlisting in the army after graduating high school is a different behavior than enlisting in the army after completing college (a change in context). Moreover, in considering behavior, it is also important to include an additional element—time. For example, assessing whether one enlisted in the army in the past 3 months is different from assessing whether one enlisted in the Army in the past 2 years. Consistent with this, the intention to enlist in the army in the next 3 months is very different from the intention to enlist in the army in the next 2 years. Changing any one element in the behavioral definition will usually lead to very different beliefs about the consequences of performing that behavior and about the expectations of relevant others, and thus to very different attitudes, subjective norms, and intentions. Although all four elements should be considered in arriving at one's behavioral criterion, the level of specificity or generality used to define each element should be determined by the substantive questions being asked. Thus, for example, behavior may be assessed at a fairly general level (i.e., people could be asked whether they have ever [time] purchased [action] cigarettes [targets]—[context unspecified]) or at a more specific level (i.e., they could be asked whether they had purchased [action] Marlboro Light 100's [target] from their local supermarket [context] in the past 2 weeks [time]).

The second step in applying the theory of reasoned action is to identify the specific population to be

considered. As indicated above, for any given behavior, both the relative importance of attitudes and norms as determinants of intention (and/or behavior) and the substantive content of the behavioral and normative beliefs underlying these determinants may vary as a function of the population under consideration. Thus, it is imperative to define the population (or populations) to be considered.

Once one or more behaviors and populations have been identified, the theory of reasoned action can be used to understand why some members of a target population are performing the behavior and others are not. As indicated above, it is necessary to go to a representative sample of the target population to identify salient outcomes and referents for the behavior in question. This formative research provides input necessary for the development of belief measures. Central to the theory of reasoned action is the concept of correspondence or compatibility. That is, for accurate prediction and full understanding of a given behavior, measures of beliefs, attitudes, norms, and intention must all correspond exactly to the behavior to be predicted. For example, if one is interested in predicting whether one will or will not always use condoms for vaginal sex with one's main partner during the next 6 months, beliefs, attitudes, norms, and intentions must all be assessed with respect to "My always using a condom for vaginal sex with my main partner for the next 6 months." By obtaining correspondent measures of all of these variables, one can determine, for example, whether a given health behavior (e.g., getting a colonoscopy) is not being performed because people have not formed intentions to get a colonoscopy or because they are unable to act on their intentions. Similarly, one can determine, for the population under consideration, whether intention is influenced primarily by attitudes or norms. Finally, one can identify the specific behavioral or normative beliefs that discriminate between those who do or do not (intend to) perform the behavior.

This type of information is essential for developing interventions to reinforce or change behavior. Clearly, different interventions are necessary if one is unable to act on one's intentions than if appropriate intentions have not been formed. If appropriate intentions have not been formed, different interventions will be necessary to change behaviors under attitudinal control than behaviors under normative control. Finally, if one is going to change attitudes or subjective norms, the more information one has about underlying

beliefs, the more likely is one to develop a successful intervention.

The theory has been used successfully to predict and explain a wide variety of behaviors, including such things as wearing safety helmets, smoking marijuana, voting, eating at fast-food restaurants, smoking cigarettes, drinking alcohol, entering an alcohol treatment program, using birth control pills, breast feeding, donating blood, wearing seat belts, condom use, recycling, church attendance, and engaging in premarital sexual behavior. It has also served as the theoretical basis for the development of a number of successful health-related interventions, particularly in the area of HIV/AIDS prevention.

Extensions of reasoned action theory include Ajzen's (1991) theory of planned behavior and Fishbein's (2000) integrative model of behavioral prediction.

—Martin Fishbein

See also THEORY OF PLANNED BEHAVIOR; THEORY OF TRIADIC INFLUENCE; TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

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## THEORY OF TRIADIC INFLUENCE

The theory of triadic influence (TTI) is one of the most integrative theories of health behavior (see

Figure 1). It explains behavior as being the result of three streams of causes of behavior (*intrapersonal*, *interpersonal*, and *sociocultural-environmental*) that flow through several levels of causation (ultimate → distal → proximal). Factors in each of the three streams interact with factors in each of the other streams. All three streams converge on decisions/intentions as the final predictor of behavior. Finally, engaging in a behavior may have effects that feed back and alter the original causes of the behavior.

The TTI provides a single, unifying framework that organizes the constructs from many other theories, including theories of social control and social bonding, social development, peer clustering, personality, cognitive-affective predictors, social/cognitive learning, biological vulnerability, and other integrative theories (see Petraitis, Flay, & Miller, 1995, for a review). TTI also provides dozens of testable hypotheses about causal processes, including mediation, moderation, and reciprocal effects. The TTI is useful not only for explaining behavior but also for designing interventions for the treatment or prevention of health-compromising or other risky behaviors, the promotion of health-enhancing and other positive behaviors, and positive youth development.

### THE CAUSES OF BEHAVIOR

In order to understand the mass of findings in the vast theoretical and empirical literature on the causes of health behavior, reviewers have proposed various groupings of causes. Three generally agreed-upon categories consist of (1) *individual/intrapersonal* (biological, personality, character traits), (2) *social contextual* (neighborhood, family, school, peers), and (3) *broader sociocultural-environmental* (economic, political, religious). These three categories underlie the three streams of the TTI.

### Levels/Tiers of Influence

The common causes of behavior listed above are causally distant from behavior, and have their actions through intervening/mediating variables. That is, they influence other variables closer (i.e., more proximal) to behavior that, in turn, cause changes in behavior. For example, families' effects on youth smoking may occur through several other variables, such as how parents interact with their children (an ultimate factor), the parents' own smoking-related attitudes



# THE THEORY OF TRIADIC INFLUENCE

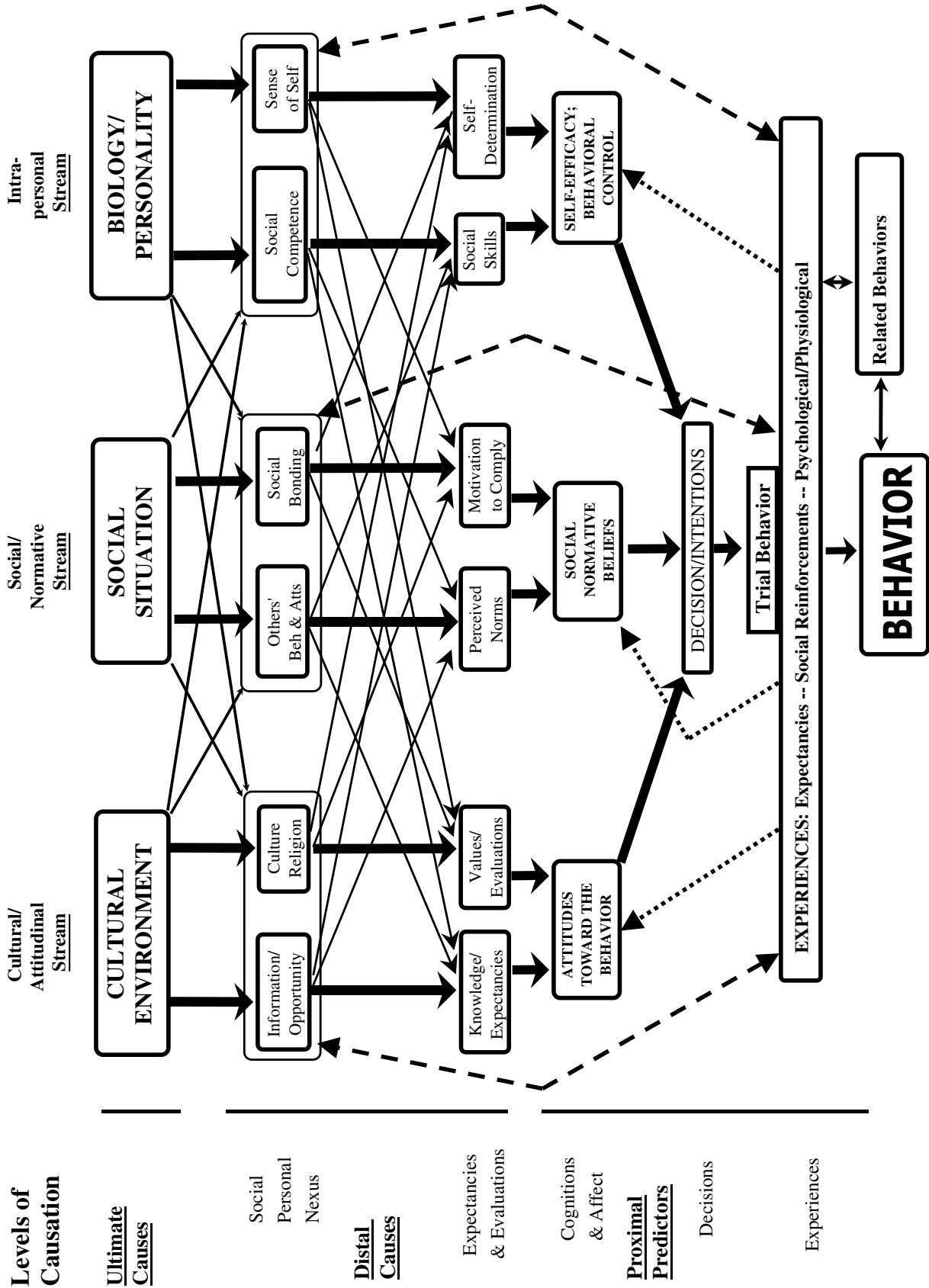


Figure 1 The Theory of Triadic Influence

and behaviors, and the children's perceptions of these (distal influences), and the children's general social normative beliefs about smoking, which in turn determine the children's decisions/intentions regarding smoking (the most proximal determinant). This is an example of a mediated causal chain and of the tiers/levels of causation in the TTI.

*Ultimate influences* are the furthest removed from behavior (e.g., neighborhood unemployment rate, rigid parenting style, biological susceptibility). As such, their effects are the most general, the most mediated, and often the most difficult for any one person or program to change. The well-known debate over the relative effects of genes and environment on behavior usually focuses on ultimate causes.

One step closer to behavior are the *distal causes*. The first level of distal causes are at the *social-personal nexus* (e.g., religious participation, bonding to parents or deviant role models, rebelliousness). Second-order distal causes, another step closer to behavior, are a set of cognitive/affective influences, called *expectancies and evaluations*. Compared to ultimate-level influences, distal-level influences are less far removed from behavior, have effects on behavior that are more specific and less mediated, and are usually less difficult to change.

Near the bottom of Figure 1 are the most *proximal causes* of behavior. Attitudes, social normative beliefs, and self-efficacy about the specific behavior (derived directly from the immediately preceding tier) have direct effects on decisions/intentions to engage in that behavior. The more proximal the cause to a behavior, the more likely it is to be specific to that behavior. For example, attitudes toward violence will be predictive of violence but less predictive of substance use or mental health. Proximal causes of behavior might be the easiest to alter in the short run.

### *Streams of Influence*

The three streams of causes of behavior in the TTI are similar to the rings of influence in Bronfenbrenner's social ecology model; however, the social ecology model does not consider the levels/tiers of causation within its rings. The TTI is also broader and specifies more detailed causal links than other biopsychosocial models.

*Sociocultural causes* of behavior include societal, ethnic/cultural, religious, political/legal, and economic

factors. They explain broad variations in behavior according to the society into which one is born and raised and one's ethnicity, culture, religion, education, and socioeconomic status. Religions, governmental regulations, educational institutions, economic systems, and opportunities place major constraints on the behavior of citizens. Witness the different behavioral patterns of people raised in different countries, political systems, or religions. They also influence the type of information and values systems available in a society (social-personal nexus). Mass media, education, religions, and other information/values systems carry many different kinds of information and values: news, that may be biased by the government of the country or locality; advertising, that may be regulated as to content or claims; and entertainment, that may help shape, as well as reflect, societal values, attitudes, and norms. Thus, the informational/values systems of society (ultimate) affect the knowledge that people learn and the values that they adopt (distal) that, in turn, influence people's decision making about their behavior (proximal).

*Interpersonal or social causes* of behavior include all of the social contexts or situations in which individuals interact with each other. These include communities or neighborhoods (ultimate), families, schools, peer groups, and friendships (distal). Communities and neighborhoods shape the general behavioral patterns of the people living in them. Families shape the behavior of their children's lives through their parenting styles and their own behavioral patterns, and by influencing selection of schools and how much time their children spend with peers versus family. These distal factors, in turn, determine individuals' perceptions of what others expect of them (perceived norms), and individuals' beliefs about how they think they should behave (motivation to comply or desire to please). These distal factors, in turn, determine social normative beliefs that, in turn, help determine decisions/intentions about how to behave (proximal).

### **Interstream Influences**

It is clear from the above descriptions that *mediation* within streams lies at the core of TTI. In addition, some mediating processes flow between streams. For instance, weak bonds to school could foster strong bonds with deviant peers (distal social-personal nexus) that would then contribute to positive expectations for

substance use (distal cultural/attitudinal). Another example is that poor behavioral control (distal intrapersonal), which might be the result of parenting, genetic predisposition, or some combination thereof, might contribute to risk-taking behavior through its contribution to involvement with risk-taking peers (distal social). Similarly, social influences might be mediated by attitudinal influences. For instance, weak bonds to school (distal social) help determine positive expectations for substance use (second-level distal attitudinal).

In addition to mediating influences between streams, there are *moderating processes* (statistical interactions) between streams (not shown in Figure 1). For example, exposure to a program (ultimate social-environmental) that teaches refusal skills might have no effect on adolescents who already have strong social skills (distal intrapersonal), but it might have its strongest effects on adolescents who have the weakest social skills. This is only one of numerous possible moderating processes within the TTI.

## FEEDBACK

The TTI further posits that each instance of a behavior has a feedback influence on its predictors; that is, effects are bidirectional. Thus, adolescents' experimentation with smoking might change their relationships with peers and family, their own perceptions of the physiological effects of smoking, and their "knowledge" or expectancies about the personal and social effects of use. As this example makes clear, these changes might occur toward the top of the streams of influence and then filter down just as original causes did, or they might (also) occur at the proximal level.

## The Role of Related Behaviors

Related behaviors influence or relate to each other in at least two ways. First, they have many of the same ultimate and distal causes. For example, youth raised in disadvantaged communities, raised by unconventional parents, or who are high on risk-taking propensity are more likely to engage in multiple problem behaviors. Second, engaging in one problem behavior alters, through the feedback mechanism described above, the causes of that behavior and closely related behaviors. For example, engaging in smoking cigarettes may change one's attitudes toward trying other substances.

## Development

The multiple causes of behavior comprise a *dynamic system* that changes as people develop and have new experiences and as they experience particular behaviors. It is clear that biological and social development also play an important role in determining behavior. As children develop, the relative importance of attitudinal, normative, and self-efficacy variables changes, with attitudinal influences being most important for younger children, social and normative processes being more important during adolescence, and self-efficacy becoming more important as youth gain more experiences.

## DESIGNING PREVENTION AND TREATMENT INTERVENTIONS

Many theories provide guidance for the design of prevention and treatment programs. The TTI is particularly useful because it is so comprehensive, addressing all of the causes of a particular behavior or class of behaviors, providing suggestions of how causal processes operate (mediating and moderating processes), and providing suggestions about how to achieve lasting effects.

First, the TTI can suggest which factors are modifiable with available resources and which are not. Clearly, interventions need to focus on those factors that are modifiable, rather than those that are not.

Second, the TTI makes it clear *why* a program's effectiveness is likely to be related to how well it addresses more rather than fewer risk and protective factors. However, the TTI, a "content" theory, does not inform us on *how* to achieve this—for this a "process" theory of change like Lawrence Green's PRECEDE-PROCEED model is also needed.

Third, the TTI suggests that it is better, in the long term, to address ultimate or distal factors rather than lower-level distal or proximal factors. If a program does not also address some of the determinants of these lower-level distal and proximal influences, they will soon be altered again, possibly changed back to their prior levels, by other influences in the students' homes, and broader social environments. Thus, to be long lasting, health promotion programs must also change the social ecologies in which people live.

Fourth, the TTI can suggest appropriate target audiences for interventions. Not all people have the same level of risk or the same reaction to a program.

For instance, a program that emphasizes the dangers of drug use might reduce the drug use of low risk takers but might promote drug use among high risk takers. Thus, the TTI, because it articulates moderating or interaction effects, can suggest populations for which programs are more appropriate, and whether prevention efforts should be universal, selective, or indicated.

Fifth, judging the potential impact of a program against the TTI might help planners anticipate the size of their program's impact. Many well-intended programs have been conducted under the assumption that simply teaching kids about the dangers of drugs will, by itself, have a meaningful impact. However, if program providers realized that information about drugs is only one variable in a more complex web of variables, they would come to expect more modest effects from their programs.

Sixth, the TTI can help locate the various effects of a particular intervention. Programs are designed to have an immediate effect on some variables that are expected to have subsequent effects on the targeted behavior. By spelling out the intervening (mediating) variables, theories allow us to measure the appropriate variables and help us locate the immediate, intermediate, and long-term effects of a program.

Finally, the TTI suggests that for program effects to be long lasting, programs must also be long lasting. After all, the influences in peoples' social environments to engage in unhealthy behavior do not go away, so programs must continue to influence or counteract them.

—Brian R. Flay

See also ADOPTION OF HEALTH BEHAVIOR; CULTURAL FACTORS AND HEALTH; THEORY OF PLANNED BEHAVIOR; THEORY OF REASONED ACTION; TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

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## TRANSTHEORETICAL MODEL OF BEHAVIOR CHANGE

The transtheoretical model (TTM) provides a framework for understanding how people change behavior to prevent disease or enhance health. The model views behavior change as occurring in a series of *stages of change*, each of which requires different strategies or *processes of change* to best help individuals make progress toward healthier lifestyles. The basic principles of the TTM, first described by James Prochaska and Carlo DiClemente around 1980, were initially intended as a framework for describing how individuals change in psychotherapy. The first health applications focused on the addictions, especially smoking cessation, alcohol abuse, and weight control. The model has since been applied extensively, providing the basis for effective "stage-tailored" interventions for many important health behaviors, including smoking, diet, sun exposure, exercise, screening mammography, alcohol abuse, weight management, stress management, and diabetes self-management.

In addition to the stages and processes of change, the TTM also incorporates a series of intervening or intermediate outcome variables, including *decisional balance* (the pros and cons of change) and *self-efficacy* (*confidence* in the ability to change and *temptations* to engage in the unhealthy behavior across challenging situations). Together with the processes of change, these constructs provide a multidimensional view of how people change, and represent a variety of theoretical orientations to the behavior change process. It is in this sense that the TTM is thought of as *transtheoretical*. Distinctive characteristics of the TTM include explicit recognition of *all* stages of readiness as important components of the change process and the emphasis placed on transitions between stages as functions of other important dimensions of behavior change. In particular, the TTM stresses the importance of the early stages of change, which are undifferentiated in most other theoretical models.

## STAGES OF CHANGE

The central organizing construct of the TTM is the concept of stages of change. Five ordered categories of readiness to change behavior have been defined: *precontemplation*, *contemplation*, *preparation*, *action*, and *maintenance*. The term *motivational readiness to change* is sometimes used synonymously to mean stages of change. The stages provide a temporal or developmental dimension that represents when change occurs.

### Precontemplation

Individuals in the precontemplation stage of change have no intention of changing their unhealthy behavior in the near future, usually defined as within the next 6 months. People in this stage may feel that they do not have a problem, or that their unhealthy behavior is not serious enough to warrant attention. They may be uninformed or underinformed about the seriousness of their behavior and the potential consequences of not changing. Individuals in the precontemplation stage may wish to change their behavior but have no serious intention of trying to do so. They may be demoralized about their chances due to repeated unsuccessful attempts to change. They tend to avoid thinking, reading, or talking about their behavior and are frequently characterized as resistant, defensive, and unmotivated. For those in

precontemplation, the costs of change clearly outweigh the benefits.

### Contemplation

Individuals in the contemplation stage of change admit that they may have a problem and are seriously considering changing their behavior within the next 6 months. They understand the benefits of change but are also very much aware of the costs, resulting in considerable ambivalence. As a result, these individuals typically do not act on their intentions and frequently remain stuck in the contemplation stage for lengthy periods of time (“chronic contemplation”). Distinctive characteristics of the contemplation stage include the substitution of thinking for action, constant struggling with weighing the costs and benefits of change, indecision, and lack of commitment.

### Preparation

Individuals in the preparation stage of change intend to act on their unhealthy behavior in the immediate future, usually defined as within the next 30 days. This stage of change is characterized by having a plan of action and by taking small steps toward action, such as reducing the number of cigarettes smoked per day, quitting smoking for 24 hours, buying a self-help book, joining a health club, or talking to health professionals. The preparation stage is also characterized by recent unsuccessful attempts at behavior change. It is this combination of intention to change with a behavioral pattern of recent attempts to change that distinguishes individuals in the preparation stage from those in contemplation.

### Action

The action stage of change is a period of active engagement in changing unhealthy behavior. The period of action is usually described as lasting for 6 months, as this typically encompasses the period of greatest risk of relapse. Not all behavior change is sufficient for an individual to be considered in the action stage. To reach action, individuals must meet a strict standard of behavior change, such as quitting smoking (rather than simply reducing the number of cigarettes smoked) or eating five or more servings of fruits and vegetables per day (rather than simply increasing the number of servings per day). The action criterion is dependent on the specific behavior and should represent

the established consensus of experts in the field as to how much change is sufficient to promote health or meaningfully reduce the chances of disease.

### Maintenance

Individuals achieve maintenance after 6 months of continuous successful action. The goal for this stage is to continue to work on preventing relapse and consolidate the gains made during the action stage. Situational temptations to engage in the unhealthy behavior decline, and confidence in coping with challenging situations increases throughout this period. Maintenance is thus a continuation of the change process and not a static period. There is still a risk of relapse, and for some individuals and for some behaviors, maintenance may be a lifelong struggle.

Progression from precontemplation to maintenance is assumed to be invariant in that individuals need to complete the tasks and consolidate the gains of one stage before they are ready to successfully progress to the next. Unfortunately, most individuals do not progress linearly through the stages. A cyclical pattern is more common: individuals reaching the action or maintenance stage may relapse and recycle to an earlier stage of change. Relapse was once considered one of the stages of change but is now viewed as an event that stops movement through action or maintenance, initiating the process of recycling. Fortunately, most individuals who relapse do not regress all the way back to precontemplation. Some of the gains made before the relapse episode are preserved, so that subsequent action attempts are more likely to be successful. The TTM views relapse not as a failure but as an opportunity to learn from previous mistakes, weed out unsuccessful change strategies, and try new approaches.

### PROCESSES OF CHANGE

The processes of change are covert and overt cognitive, affective, evaluative, and behavioral strategies and activities used by individuals to progress through the stages of change. A comparative analysis of more than 300 theories of psychotherapy identified 10 fundamental processes of change, such as consciousness raising (Freudian), contingency management (Skinnerian), and helping relationships (Rogerian). While additional processes of change have since been identified as important for specific health behaviors, 10 have been consistently supported across a wide

range of behaviors. The processes are organized into two general higher-order processes. The experiential processes incorporate cognitive, affective, and evaluative aspects of change, whereas the behavioral processes include more specific, observable change strategies. The experiential processes include *consciousness raising* (efforts by the individual to increase awareness, seek new information, and gain understanding and feedback about their behavior), *dramatic relief* (experiencing and expressing feelings about their behavior and potential solutions, resulting in increased, often intense, emotional experiences), *environmental reevaluation* (affective and cognitive consideration of how their behavior affects their physical and social environment), *self-reevaluation* (emotional and cognitive reappraisal of personal values and reassessment of self-image with respect to behavior), and *social liberation* (awareness of social norms and the fact that alternative, healthy lifestyles are both available and acceptable). The behavioral processes include *contingency (reinforcement) management* (rewarding oneself or being rewarded by others for making appropriate changes, including punishment, but more typically using positive reinforcement), *counterconditioning* (substitution of alternative healthier behaviors as replacements for unhealthy behaviors), *helping relationships* (trusting, accepting, and utilizing the support of caring others during attempts to change behavior), *self-liberation* (choosing and committing to change as well as personal belief in the ability to change), and *stimulus control* (removal of cues for unhealthy behaviors, addition of cues for healthy alternatives, avoiding challenging social situations, and seeking alternative environments that provide support for healthier behaviors).

### DECISIONAL BALANCE: PROS AND CONS OF CHANGE

Part of the decision to move from one stage to the next is based on the relative weight given to the pros and cons of changing behavior. The pros represent positive aspects or advantages of change, and the cons represent negative aspects or disadvantages of change. The comparative weighting of the pros and cons varies depending on the individual's stage of change. In the precontemplation stage, the cons of change outweigh the pros, whereas in the action and maintenance stages, the pros outweigh the cons. The positive and negative aspects of change are usually about equal in the contemplation stage. The resulting indecision

and lack of commitment is largely responsible for individuals becoming stuck in the contemplation stage, substituting thinking for action while continually struggling with the costs and benefits of change. Decisional balance serves as an intermediate outcome variable in the TTM, the increase in the pros from precontemplation to contemplation being especially striking. Thus, the pros are an excellent indicator of the decision to move out of the precontemplation stage. The relationship between the stages of change and decisional balance has been shown to be very consistent across a wide range of health behaviors.

### Self-Efficacy: Confidence and Temptation

The self-efficacy component of the TTM was adapted from cognitive-social learning theory. In the TTM, self-efficacy typically takes the form of asking individuals how *confident* they are that they will not engage in an unhealthy behavior and how tempted they would be to engage in an unhealthy behavior across a range of challenging or difficult situations. Both constructs are usually designed to be multidimensional in assessing situational determinants of relapse. Confidence and temptation typically show only modest relationships to stage of change from precontemplation to preparation, followed by strong and essentially linear increases and decreases from preparation to maintenance, respectively. Both constructs serve as indicators of relapse risk for individuals in the action and maintenance stages.

### INTEGRATION OF TTM CONSTRUCTS

The stages and processes of change are integrally related. Transitions between stages are mediated by the use of distinct subsets of change processes and are associated with substantial changes in decision making and self-efficacy. Individuals in the earlier stages of change tend to rely on the experiential processes of change and report relatively little confidence in their ability to change and relatively high temptation to engage in unhealthy behaviors across difficult situations. The cons of change typically outweigh the pros. Individuals in the later stages tend to rely on the behavioral processes, report more confidence in the ability to change and relatively less temptation to engage in unhealthy behaviors, and evaluate the pros of change more highly than the cons. Consideration of

these relationships is important for the development of effective interventions. When treatment programs ignore or mismatch processes to stages, behavior change attempts are likely to fail. Interventions that deliver stage-specific interventions may accelerate progress through the stages. An important advantage of this approach is that stage-tailored interventions can be applicable not just to individuals who are ready to change behavior but to the majority of the population who are neither prepared nor motivated to change.

—Joseph S. Rossi

See also ADOPTION OF HEALTH BEHAVIOR; MOTIVATIONAL INTERVIEWING; SELF-EFFICACY; SMOKING AND NICOTINE DEPENDENCE; INTERVENTIONS; TAILORED COMMUNICATIONS; THEORY OF PLANNED BEHAVIOR; THEORY OF REASONED ACTION; THEORY OF TRIADIC INFLUENCE

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**TYPE A BEHAVIOR.** See HEART DISEASE AND TYPE A BEHAVIOR

# V

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## VIOLENCE PREVENTION

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This entry provides a brief explanation of the three levels of preventive intervention, followed by an overview of the prevalence and prevention efforts for four major categories of violence in the United States: youth violence, suicide, child maltreatment, and intimate partner and sexual violence. Although space limits the breadth and depth of scope for this extensive topic, it is hoped that the reader will pursue more extensive readings on each of these and other violence-related topics as well as the many violence prevention efforts too numerous to mention. Before turning to the various manifestations of violence and their prevention, it is helpful to briefly explain the Institute of Medicine's report of summarizing the three levels of preventive intervention efforts. *Universal* violence prevention programs are designed to reach a wide audience of individuals who may or may not have experienced any aspect of violence. By exposing a large number of individuals to preventive information about violence, the goal is to decrease the prevalence of the behavior among a vast audience. *Selective* programs, however, are designed to target a specific audience with one or more risk factors associated with participating in violence behaviors such as exposure to interpersonal, community, or neighborhood violence. Selective interventions are typically designed to modify a malleable risk factor or to increase known protective factors in order to prevent violence behavior among individuals who have a higher likelihood of participating in violence.

*Indicated* programs are designed for individuals who are already participating in violence behaviors. The goal of indicated programs is to stop *future* participation in violence behaviors.

For all four violence areas, the vast majority of rigorously evaluated and funded interventions are selective and indicated programs.

### YOUTH VIOLENCE

Homicide is the second leading cause of death among 15- to 24-year-olds overall. In 1999, 4,998 youths ages 15 to 24 were murdered—an average of 14 per day. Guns are a factor in most youth homicides. In 1999, 81% of homicide victims ages 15 to 24 were killed with firearms. Although typically overestimated, school-associated violent deaths represent less than 1% of all homicides and suicides that occur among school-aged children.

Historically, violence prevention and intervention efforts have been the purview of the criminal and juvenile justice system and as such have been mired by the fact that the justice system largely interacts with youth who have already committed a violent crime. Indicated intervention efforts aimed at rehabilitating youth to prevent recidivism have been somewhat successful; however, the juvenile justice system has had little to no impact in terms of preventing youth from becoming involved with violence.

Over the past decade, there have been efforts to develop and evaluate universal school-based violence prevention efforts. Four universal programs have emerged as effective: Promoting Alternative THinking



Strategies (PATHS), Bullying Prevention Program (BPP), Life Skills Training (LST), and the Midwestern Prevention Project (MPP). Interestingly, the latter two programs focus on drug prevention but appear to have more generalized effects for reducing youth violence. Community-based violence prevention efforts are selective programs that target areas particularly plagued with neighborhood or community violence. Because these community-based programs (e.g., Detroit's Save Our Sons and Daughters Program) are recent undertakings, they do not yet have reported results.

## SUICIDE

Overall, suicide is the 11th leading cause of death for all Americans and is the third leading cause of death for young people aged 15 to 24. Males are four times more likely to die from suicide than are females. However, females are more likely to attempt suicide than are males. Nearly three of every five suicides in 1999 (57%) were committed with a firearm. Suicide rates tend to increase with age and are highest among Americans aged 65 years and older. This trend is marked by the fact that 1980-1990 was the first decade since the 1940s that the suicide rate for older individuals rose instead of declined.

Because of the high association of mental disorder, suicide prevention programs have tended to focus on identifying and treating clinical levels of depression or other mental illness. Suicide prevention programs can generally be classified into one of five types: (1) increasing training for community and institutional gatekeepers to identify and refer those at-risk for suicidal behavior, (2) treating the underlying risk factors associated with suicide such as depression or alcohol and drug abuse, (3) providing general education about suicide vulnerabilities, (4) reducing access to lethal means such as guns, and prescription drugs, and (5) developing self-referral sources such as hotlines. While each of the above programs has the potential to avert suicide, there are many and varied risk factors associated with suicidal behavior. The effectiveness of these five approaches has yet to be demonstrated, thus potentially hindering prevention program implementers, community/institutional gatekeepers, and policymakers in their efforts to educate their constituencies about the array of suicide prevention tools currently available.

## CHILD MALTREATMENT

Child maltreatment includes physical abuse, neglect (physical, educational, emotional, and/or medical), sexual abuse, emotional abuse (psychological/verbal abuse/mental injury), and other types of maltreatment such as abandonment, exploitation, and/or threats to harm the child. Every year, an estimated 826,000 children experience nonfatal child maltreatment. Though the risk factors are varied, an ecological approach takes into account the parent's background, the child's temperament, and societal aspects related to child maltreatment. This framework underscores the need for prevention programs to go beyond simplistic parent education programs to better effectively target the complex interaction between parents, children, and the society in which they live.

Universal programs to prevent child maltreatment are typically public awareness messages where parents are informed about child maltreatment along with ways to get help when they feel out of control. There has been, however, no systematic evaluation of the value of these messages. Selective interventions are aimed at families where the risk factors for child maltreatment are high. An example is the Home Visitation Program by David Olds and associates. This program targeted young, single, low-income mothers using a comprehensive approach where mothers were visited in their homes with parent education and informal support, as well as being connected to available social and health services, including adequate health care. Evaluations of this program have demonstrated a reduction in child maltreatment along with a host of other positive benefits for the child and the mother. Indicated interventions are typically run by social and/or human service agencies, since these families have had one or more children who have been maltreated. While there is no data on the effectiveness of these state-run indicated programs, program officials have long advocated for comprehensive programs that deal with the wide spectrum of problems that these families face.

## INTIMATE PARTNER AND SEXUAL VIOLENCE

Available data suggest that violence against women is a substantial public health problem in the United States. Every year, an estimated 4,000 females die as the result of homicide. Thirty percent of these women were known to have been murdered by a

spouse or ex-spouse. Data on nonfatal cases of assault are less easily accessible, but recent survey data suggest that approximately 1.3 million women have been physically assaulted annually, and approximately 200,000 women have been raped annually by a current or former intimate partner.

Universally targeted public awareness messages about intimate partner and sexual violence prevention have not been systematically evaluated for their effectiveness. Examples of selective programs are those delivered on college campuses focusing on correcting intimate partner violence myths, understanding consequences for such violence, increasing assertiveness and self-defense skills, as well as helping students learn to avoid high-risk situations. Results of these programs have been mixed, partially due to the fact that these interventions have tended to be one-time, short duration programs, thus inhibiting their potential effectiveness. Indicated programs for offenders have also tended to focus on dispelling intimate partner violence myths, effective anger management, and engaging empathy for the victims. Indicated program results have relied on recommitment of a crime (recidivism) as an index of program success and as such is a limited indicator of intimate partner violence prevention.

—Paula Smith

See also CHILD ABUSE, CHILD NEGLECT, AND HEALTH

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## VITAL EXHAUSTION

Vital exhaustion is a psychosocial risk indicator for adverse cardiovascular health outcomes, including myocardial infarction and recurrent cardiac events following percutaneous coronary interventions. Exhaustion has three characteristic components: lack of energy, increased irritability, and demoralization. The duration of an episode of exhaustion can vary from 2 weeks to 2 years. Individuals should not be classified as exhausted if the condition lasts longer than 2 years without showing an increase within that period. Reliable questionnaire and interview-derived assessment instruments have been developed. In patients with cardiovascular disease, prevalence estimates of exhaustion range from 30% to 50%, compared to 5% in the general adult population. Exhaustion is purportedly the end stage of prolonged uncontrollable psychological distress and has biological correlates relevant to the pathophysiology of cardiovascular disease progression. Psychosocial intervention techniques have been proven feasible in patients with coronary artery disease.

The construct *vital exhaustion* was developed using empirical techniques aimed to identify premonitory symptoms of myocardial infarction. Pivotal research has been conducted by Dr. Ad Appels and his colleagues in the Netherlands. The prefix *vital* was included to reflect the far-reaching consequences of this condition on daily life function (similar to vital depression) and is not used in the remainder of this text.

### ASSESSMENT

Exhaustion can be assessed with the 21-item Maastricht Questionnaire (MQ) or, preferably, with the Maastricht Interview for Vital Exhaustion.

The Maastricht Questionnaire has been used in a variety of clinical and epidemiological settings in over 15 countries. Factor analysis has confirmed that exhaustion has three main components (lack of

energy, increased irritability, and demoralization), and possibly a separate factor indicating sleep problems. Items are scored from 0 (symptom absent) to 2 (symptom present), and question marks are coded as 1, resulting in a possible score range from 0 to 42. Two additional items have been added to the questionnaire to better assess the irritability component (the MQ-23). Validation for these additional 2 items is limited, and the 21-item version is most commonly used. The mean and standard deviation of the questionnaire is  $8.8 \pm 8.7$  for healthy adults. Hospitalized patients without cardiovascular disease have MQ scores of  $11.7 \pm 9.8$ , and patients with documented cardiovascular disease have scores of  $18.5 \pm 9.5$ . The questionnaire's reliability is satisfactory (Cronbach's  $\alpha = 0.80$ ). Consistent with most psychological self-report measures, women tend to score 0.5 standard deviation higher than men. For clinical and research selection purposes, several cutoffs have been used to identify "exhausted" individuals, ranging from 14 to 18, depending on the importance of false positives or false negatives.

The Maastricht Interview for Vital Exhaustion has 23 items derived from the questionnaire and inquires about the presence and duration of exhaustion symptoms. The interview has adequate internal consistency (Cronbach's  $\alpha = 0.86$ ) and interrater reliability ( $\kappa = 0.91$ ). The correlation between questionnaire and interview scores is 0.74. Interviews are diagnostic for exhaustion if (a) seven or more of the items are scored positive and (b) at least one of the three exhaustion components shows an increase in severity in the past 2 years. The major advantage of the interview over the questionnaire is its superiority in preventing diagnosis of false positives.

## PREVALENCE

Exhaustion is common in patients with established coronary artery disease, with prevalence estimates ranging from 30% to 50% (mean MQ scores  $18.5 \pm 9.5$ ; see above). In healthy adults, the prevalence is substantially lower, and selection strategies for psychophysiological studies should target a prevalence of 5%.

Because fatigue and lack of energy are common symptoms of a variety of general medical conditions, exhaustion scores are often elevated in individuals attending health care clinics and those hospitalized for noncardiac medical conditions. There is also overlap between symptoms of depressive mood disorders and

exhaustion. Research on the convergent and divergent validity of these two constructs is still in progress; preliminary data suggest that 57% of exhausted individuals do not meet criteria for major or minor depression. Most individuals (> 90%) meeting criteria for major depression also meet criteria for exhaustion. Important differences exist in the biological concomitants of exhaustion and depression, including circadian variation of cortisol and hemostatic measures. Exhaustion is also more common than major depression in cardiac patients, and may therefore be an additional psychosocial risk indicator for adverse disease progression.

## ETIOLOGY AND THEORETICAL BACKGROUND

Exhaustion reflects the end stage of prolonged and uncontrollable psychological distress. The etiological theory for exhaustion builds on Selye's general adaptation syndrome, which postulates that prolonged physical or emotional challenges result in a state of exhaustion associated with elevated risk of morbidity and mortality. The psychosocial precursors as well as biological correlates of exhaustion support this etiological theory.

Exhaustion is more prevalent among individuals who experience prolonged psychological distress. For example, cross-sectional studies indicate that the prevalence of exhaustion is higher among individuals of low socioeconomic status and Type A behavior pattern and/or hostility. No studies have examined race and ethnicity as predictors of exhaustion.

Because exhaustion is commonly observed in patients with cardiovascular diseases, research has examined to what extent exhaustion reflects underlying disease severity. No associations have been found between exhaustion and the anatomical severity of coronary disease, cardiac pump function at rest, or inducible ischemia in response to exercise or mental arousal. In selected cases, however, complaints of exhaustion may reflect severe cardiac pathology. As described below, exhaustion has biological correlates, including elevated markers of inflammation and proinflammatory cytokines. These inflammatory factors could be secondary to underlying cardiovascular disease, and the role of immune system parameters in the etiology of exhaustion requires further investigation. Furthermore, there may be a circular influence between exhaustion and adverse health behaviors, including low exercise, smoking, and coffee consumption.

BIOLOGICAL CORRELATES

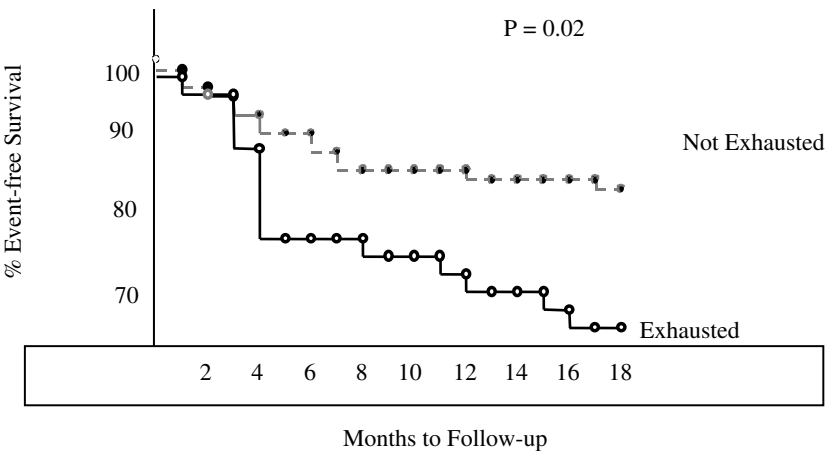
Research has indicated the following biological correlates of exhaustion: flattened diurnal cortisol profile; increased coagulation factors; impaired fibrinolysis upon awakening; and increased markers of low-grade inflammation (e.g., C-reactive protein), and possibly increased pathogen burden (e.g., cytomegalovirus). No consistent evidence has been found for altered cardiovascular reactivity or hypercortisolemia, or adverse lipid profile. Finally, exhaustion is characterized by reduced duration of deep sleep stages, altered autonomic nervous system function (reduced parasympathetic activity), and possibly impaired exercise tolerance (see Table 1).

**Table 1** Biological Correlates of Exhaustion

<i>Cardiovascular Factor</i>	<i>Measures</i>
<i>Hemostasis</i>	
Low-grade Inflammation	C-reactive protein, white blood cell count Pro-inflammatory cytokines, lower albumin
Coagulation	Fibrinogen, Factor <sub>I+2</sub>
Fibrinolysis (morning)	Plasminogen activator inhibitor-1 activity, t-PA antigen
<i>Neuroendocrine</i>	
Autonomic Nervous System	Heart rate variability reduced
Cortisol	Diurnal variation flattened
Sleep	Slow wave sleep reduced

HEALTH RISKS

The primary health risks associated with exhaustion include incident and recurrent cardiac events. Prospective studies in healthy individuals indicate that exhaustion is associated with an excess risk of first myocardial infarction (RR = 2.3, *p* < .001) and unstable angina during 4-year follow-up. In patients undergoing successful coronary angioplasty, exhaustion is associated with a greater than twofold risk of recurrent



**Figure 1** Predictive Value of Exhaustion for New Cardiac Events During 1.5-Year Follow-Up

cardiac events within 1.5 years (OR = 2.7; 95% CI = 1.1-6.3). As shown in Figure 1, cardiac events (cardiac death, myocardial infarction, bypass surgery, documented coronary disease progression) occurred more often in exhausted than nonexhausted patients during follow-up. Most research suggests that the predictive value of exhaustion is primarily observed within 2 years after assessment. Case-control studies indicate that exhaustion is also associated with elevated risk of sudden cardiac death, and that cardiovascular risks are similar for men and women.

The theoretical framework of the etiology of exhaustion, as well as its biological correlates, does not preclude exhaustion as a risk factor for adverse health outcomes other than cardiovascular disease. However, empirical evidence has as yet not supported such associations.

TREATMENT STRATEGIES

Interventions specifically targeting exhaustion have focused on stress-management strategies, including relaxation, management of hostile attitudes and behaviors, and breathing techniques. Preliminary analyses indicate that exhaustion can be successfully treated by psychosocial interventions. The most efficient setting for such interventions appears to be in small groups (approximately eight participants). Pharmacological trials using SSRIs and related compounds in different contexts (e.g., posttraumatic stress disorder) have resulted in significant reductions of exhaustion scores. A large randomized trial currently investigates the efficacy of psychological

interventions in over 700 exhausted postangioplasty patients.

## CONCLUSION

Exhaustion consists of three components: lack of energy, increased irritability, and demoralization. The duration of an episode of exhaustion can vary from 2 weeks to 2 years. The risk ratios of exhaustion for cardiovascular disease are similar to traditional risk factors such as hypertension and hypercholesterolemia. Exhaustion is hypothesized to result from prolonged uncontrollable psychological distress and has biological correlates relevant to the pathophysiology of cardiovascular disease progression. The role of inflammatory processes in the etiology of exhaustion requires further investigation. Understanding the mechanisms accounting for the relationship between exhaustion and cardiovascular disease may help to direct the timing and nature of psychosocial interventions in patients at risk for clinical coronary artery disease.

—Willem J. Kop

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## WOMEN'S HEALTH ISSUES

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Women's health issues have traditionally been defined in terms of reproductive health such as menstrual cycles, infertility, pregnancy, and menopause. However, women's health is now considered to encompass a much wider range of topics, including diseases that are more common in women (such as osteoporosis, lupus, depression, and diabetes) as well as the leading causes of death among women (coronary heart disease, AIDS, and lung cancer). Women's health issues also include gender differences in health risks (such as substance abuse and physical inactivity); how societal influences such as social norms, poverty, and caregiving impact women's health; and violence against women. Sex differences in physiology and anatomy related to health consequences are also a growing area of interest. A 2001 report from the Institute of Medicine concludes that differences in the prevalence and severity of a broad range of diseases and conditions exist between the sexes and that the distinct anatomy and physiology of being male or female has a broader influence on health than previously thought. Differences in health are influenced by individual genetic and physiologic conditions as well as by one's experiences and interactions with environmental factors.

This entry is organized around a paradigm developed by Chesney and Ozer, which provides a model of ways to view women's health issues. First, there are key content areas such as the leading causes of death among women, diseases more common in women, reproductive health, and gender and societal influences

on health risk. Underlying this content layer are processes that span content areas that include the diversity of participants and use of gender-appropriate methods and measures in health research studies. Women's health issues encompass an extremely broad area, and this entry can only briefly mention some of these key areas.

### CONTENT AREAS

#### **Demographics and Leading Causes of Death Among Women**

##### *Demographic Patterns*

Currently, the life expectancy of a non-Hispanic White woman in the United States is 80 years, and it is approximately 75 years for an African American woman. In the next 50 years, it is projected that the United States will experience a shift toward an increasingly older U.S. female population. The aging of the female population is likely to result in larger numbers of elderly women living with chronic illnesses and/or functional disabilities. The racial and ethnic mix of the U.S. female population will also change dramatically during that time. The Hispanic female population is expected to increase from the current 11% to approximately 20% of U.S. females by 2050. The Asian American female population is also projected to rise from 4% of the current total population to 9% of U.S. females in 2050. Non-Hispanic White women, who comprise approximately 70% of the female population, are anticipated to account for only 60% of the population in 2030 and only 35% in 2050. This diversity in the U.S. female population has

implications for future health care delivery systems and the need for health care workers to be knowledgeable of health conditions affecting women of diverse ethnic backgrounds.

### *Leading Causes of Death*

The leading causes of death in women across all age groups are (a) diseases of the heart, (b) cancer, (c) cerebrovascular diseases, (d) chronic obstructive pulmonary diseases, and (e) pneumonia and influenza. This rank order of causes of mortality is also the same for White and African American women. Hispanic women share the top three causes of death, but diabetes mellitus is the fourth leading cause of death for women of this ethnicity, followed by pneumonia and influenza and then chronic obstructive pulmonary disease as the sixth leading cause of death. Differences in this rank ordering are attributed largely to the lower rates of smoking among older Hispanic females. Causes of mortality also vary by age group, as well as ethnicity, with deaths in younger women occurring more from accidental, violent, or infectious causes rather than chronic conditions.

**Cardiovascular disease.** Although heart disease and stroke are still perceived by some as affecting men primarily, more than half of the deaths from cardiovascular disease occur among women. Cardiovascular disease is the leading cause of death among women, and mortality rates are higher for African American than White or Hispanic women. Cardiovascular disease kills more women each year than all forms of cancer combined, and stroke kills more than twice as many American women as breast cancer. Heart disease in women often goes undetected and untreated until the disease has progressed. As a result, approximately 40% of women who have heart attacks die within 1 year, compared to roughly 25% of men. African American women with heart disease have 3 to 4 times greater risk of death from heart disease than either White or Hispanic women and 2.5 times the mortality rate from cerebrovascular diseases. Similarly, women account for about 40% of new strokes each year, but approximately 60% of stroke deaths.

**Cancer.** Since 1987, lung cancer has been the primary cause of cancer mortality in U.S. women, followed by deaths from breast and colorectal cancers respectively.

The lung cancer mortality rate has been attributed to the increases in rates of women's cigarette smoking during the 1950s and subsequent decades. Breast cancer incidence rates declined during the early 1990s, primarily in younger women, due to improved treatments and early detection. Although rates of breast cancer are higher for Whites, African American women are more likely to die from breast cancer. Incident rates of endometrial and uterine cancer have remained relatively constant. Rates for cervical cancer have declined markedly over the past 30 years, due to widespread use of Pap tests to detect cancerous and precancerous lesions. For both endometrial and cervical cancers, mortality is highest for African American women than for Whites, Hispanics, and Asian Americans. Ovarian cancer accounts for approximately 4% of all cancer deaths, and although it is a rare cancer, the lack of techniques for the early detection of this condition have resulted in its being responsible for more deaths than any other cancer of the female reproductive system.

## DISORDERS MORE COMMON IN WOMEN THAN MEN

### **Eating Disorders**

Eating disorders, including anorexia nervosa and bulimia, are more prevalent and are on the increase among women in the United States. Eating disorders affect an estimated 5 million Americans annually, 90% of whom are young females. Approximately 1% of young women will develop anorexia nervosa, and bulimia affects approximately 1% to 3%. Both of these disorders are initiated primarily in mid to late adolescence. Only about half of those who develop both conditions will recover fully. The remainder will have some lifetime struggles with the illness, as well as some debilitation secondary to their eating disorders.

### **Mental Health**

In any given year, approximately 13% of women will have a diagnosable depressive disorder. About one in five women will experience an episode of major depression during her lifetime, twice the rate seen in men. Anxiety disorders are also more common in women than in men. Although they often receive less attention than depressive disorders, anxiety disorders are the most common psychiatric disorders in the

United States. Slightly more than one third of women will experience an anxiety disorder in their lifetime; in any given year, almost a quarter of American women will be affected with an anxiety disorder. Anxiety disorders include such diagnoses as specific phobia, social phobia, agoraphobia, panic orders, and generalized anxiety disorder. Psychiatric disorders often go undetected and treated in women, and it is estimated that only 30% of patients with anxiety disorders actually receive treatment for their conditions.

### **Autoimmune Diseases**

Autoimmune diseases, conditions where the body's immune system becomes defective and produces antibodies against normal parts of the body, comprise a list of approximately 80 serious, chronic conditions that are a major source of disability in women, including multiple sclerosis, fibromyalgia, scleroderma, and systemic lupus erythematosus. About three quarters of these autoimmune diseases occur in women, primarily during the childbearing years. Multiple sclerosis, one of the most common, is most often diagnosed in women in their 20s and 30s, at almost double the rate of men. Eighty percent of fibromyalgia occurs in women. Scleroderma affects women, particularly African American women, three times more often than men overall, and this rate increases drastically during the childbearing years. In addition, approximately 90% of all cases of systemic lupus erythematosus occur in women, and it is three times more common in African American than White women.

### **Diabetes**

Diabetes mellitus is a common chronic illness characterized by defects in the body's ability to produce or use insulin. Approximately 8 million women in the United States have diabetes compared to 7.5 million cases in men. About a third of men and women do not know they have the disease. The prevalence of diabetes is higher in Native American, African American, and Hispanic women than White women. Diabetes increases the risk of cardiovascular disease, the primary cause of death among women, and is also a major cause of disability and dependency in older women. Diabetes also increases the risk of developing cerebrovascular disease, blindness, end stage renal disease, and nontraumatic lower extremity amputation due to peripheral vascular disease. In

addition, epidemiological studies have established an association between diabetes and dementia secondary to Alzheimer's disease and cerebrovascular disease.

### **Arthritis**

Approximately 30 million women are affected by some type of arthritis, which accounts for nearly two thirds of all persons living with these diseases. Arthritis causes an inflammation of a joint(s), usually accompanied by pain and swelling. Arthritis can limit an individual's use of the affected joints, such as the fingers, knees, or shoulder, making the performance of usual daily activities more challenging and painful. Osteoarthritis in women accounts for approximately 75% of all cases, and rheumatoid arthritis in women accounts for about 70%. Girls represent approximately 86% of all cases of juvenile rheumatoid arthritis.

### **Urinary Incontinence**

Urinary incontinence, characterized by the involuntary loss of urine that is socially and hygienically undesirable, is a major health problem among women in the United States. One in four women ages 30 to 59 years has experienced an episode of urinary incontinence, and it is estimated that 30% of elderly American women have some form of urge incontinence. Health care costs related to incontinence are greater than \$16 billion each year, with more than \$1 billion alone being spent on disposable sanitary products. Urinary incontinence can result in reductions in one's life quality and roles, and is a major predictor of women's ability to live independently as they age.

### **Osteoporosis**

Eighty percent of osteoporosis—a disease characterized by low bone mass and structural deterioration of bone tissue leading to bone fragility—occurs in women. Another significant portion of adult women have osteopenia (low bone mass), which puts them at increased risk for developing osteoporosis and/or fractures. About one out of two women and one out of eight men over the age of 50 years will have an osteoporotic-related fracture of the vertebrae or hip. Women lose up to 20% of their bone mass in the first 5 to 7 years following menopause, and intervention efforts have recently targeted this group of women to prevent the occurrence of fracture-related injuries or



disabilities. About 15% to 20% of those who have a hip fracture will not survive the 6 months after the fracture. At least half of those who do survive will require assistance in performing their daily activities, and 15% to 20% enter a long-term care facility. Thus, the prevention of osteoporosis is a major focus in women's health currently.

### Dementia

Dementia is a pathological age-related condition manifested by declines in cognitive, behavioral, and emotional functioning leading to dependency on others. Alzheimer's disease (AD) is the most common form of dementia, followed by vascular disease and degenerative diseases of the brain such as Parkinson's disease and other more obscure disorders. Dementia is a major health problem of older adults. Approximately 14 million Americans will develop AD alone by 2050 unless a cure or prevention is found. The rate of dementia is two to three times higher in women than men. Diseases most common to women that may also increase risk of dementia (Alzheimer's type and vascular) include heart disease, hypertension, and diabetes.

## REPRODUCTIVE AND POSTREPRODUCTIVE HEALTH

### Gynecological Health

Gynecological issues during childbearing years (ages 15-44) largely focus on problems related to menstruation (irregular periods, bleeding problems, painful menses and premenstrual-related symptoms, amenorrhea); contraception, sexual functioning, and sexually transmitted diseases; and pregnancy-related concerns. The term *premenstrual syndrome* is used to describe a range of symptoms, such as bloating, breast tenderness, abdominal cramps, and mood changes, that occur in 70% to 80% of women immediately prior to, during, or immediately following the monthly menstrual cycle. A more severe version of this syndrome, premenstrual dysphoric disorder, occurs in approximately 4% to 7% of all women, and can lead to major disruptions in a woman's daily activities. Endometriosis—dislocation of the endometrial lining of the uterus to other locations in the pelvis is more likely to occur in women between 25 and 40 years of age, and causes dysmenorrhea, pelvic

pain, heavy or irregular periods, and sometimes infertility. Uterine fibroids, which are more common in African American women, occur in 20% of women of reproductive age, and cause unusual or heavy menstrual bleeding, anemia, dysmenorrhea, pelvic pain, and infertility.

Hysterectomy is the second most frequently performed surgical procedure among women in the United States. Hysterectomy is performed most often between the ages of 35 and 54 years, peaking in the 40- to 44-year-old age group. The majority of hysterectomies do not occur for cancerous conditions, but in fact are performed due to complications related to uterine fibroids. In general, hysterectomy does not lead to serious complications, but the removal of the uterus and possibly the ovaries may have adverse effects on a woman's physical and emotional health. Alternatives to hysterectomy include endometrial ablation, used to control excessive uterine bleeding, myomectomy (the surgical removal of the fibroids without removing the uterus), and hormone-related therapies. Vaginal hysterectomy is also being performed more commonly to reduce the morbidity surrounding surgery as well as to reduce health care costs.

### Pregnancy, Infertility, and Contraception

Teenage pregnancies have declined over the past decade, with the largest declines among African American and young Hispanic women. However, births to teenagers remain a continuing concern. Many young women lack access to adequate prenatal care, and face increased risks for premature and low birth weight infants.

Sexually transmitted diseases (STDs) are an ongoing concern in this age group and can also lead to infertility and other chronic health risks. Endometriosis and pelvic inflammatory diseases also place women at increased risk for infertility, as do smoking and high doses of caffeine. Methods such as oral contraceptives are highly effective when used properly to prevent pregnancy but offer no protection in the prevention of STDs, including HIV.

Success of contraception is largely dependent on behavior. Some women lack the ability to use contraceptive methods appropriately, and in some relationships, male partners refuse to use contraception. For these reasons, forms of contraception that are not directly linked to the sexual act are needed

(e.g., injections, implants). However, as noted above, these do not protect against STDs.

### Childbirth

Although maternal mortality related to pregnancy has declined steadily over the past 60 years, conditions such as pregnancy-induced hypertension and ectopic pregnancy have been increasing, and if left undetected or untreated, can cause maternal death. Deliveries by Cesarean section have also increased markedly since 1970, from 6% of all deliveries to 21% in 1998. The use of obstetric intervention during delivery, such as the use of medications to induce labor, fetal monitors, and forceps, is also on the rise. In addition, although systematic reviews of randomized research studies have concluded that there is no evidence of benefit to performing routine episiotomies, this procedure is still performed on approximately 50% of all women giving birth in hospitals—which is still the setting where 99% of births to women in the United States occur.

### Menopause

At the other end of the reproductive cycle is the cessation of menses or menopause. Menopause is receiving increasing attention as baby boomers reach their 50s, as epidemiological data suggest that the decline in ovarian function may contribute to other conditions, and as the controversy over the use of hormone replacement therapy increases. Although the median age of menopause is between 51 and 52 years, the age at which women reach menopause varies considerably. The vast majority of women experience menopause between the ages of 45 and 55. Though many factors have been thought to influence a woman's age of menopause, the most consistent factor is smoking. Women who smoke experience menopause from 1 to 2 years earlier than nonsmokers. Although women have often been thought to experience a wide range of symptoms such as dizzy spells, irritability, depression, anxiety, trouble sleeping, and sexual dysfunction during the menopausal transition, only vasomotor symptoms (hot flashes and night sweats) have been clearly associated with menopause status, distinct from chronological aging. There is great variation among women in the frequency and severity to which these symptoms are experienced, but for some women they can be quite severe and are the

primary reason that women seek hormonal therapy (HT). While HT has been shown to be the most effective treatment option for relieving vasomotor symptoms, many women are concerned about troubling side effects and potential risks associated with HT such as irregular bleeding, increased breast tenderness, increased risk of breast cancer and endometrial cancer, and thromboembolic events. For these reasons, many women seek alternative therapies for relief, for example, herbal products. However, at this point in time, there is no scientific evidence of the effectiveness of these alternatives. This continues to be an active area of investigation.

### GENDER INFLUENCES ON HEALTH RISKS

Another area of women's health includes gender differences in behaviors such as substance abuse and physical inactivity. Substance abuse is a preventable and treatable condition that imposes huge costs to society. These costs are measured by disease and death, lost productivity, violence, unwanted or unplanned sex, foster child care, and homeless shelters. A number of issues related to substance abuse differ by gender. Females are more likely than males to initiate substance use to manage depression and anxiety and escalate to abuse in response to these mood disturbances. Depression is also a more common sequelae of chronic substance abuse in women. Women begin using illicit substances at a slightly later age than men and are strongly influenced by spouses and boyfriends who use. Although males are more likely to report initial exposure to illicit drugs, data suggest that women may be as likely to make a transition to drug use after initial exposure.

A similar pattern is seen in exposure to cigarette smoking as more women are taking up the habit and fewer are quitting. Nicotine in cigarettes induces euphoric or relaxing sensations, which relieve symptoms of emotional stress and reinforce repeated use. Trying to quit smoking produces a withdrawal syndrome characterized by irritability, lack of concentration, and weight gain. There is consistent evidence that nicotine replacement via gum and/or patch is less successful for women than men. Yet, most smoking abstinence programs rely heavily on nicotine therapy. Other treatment strategies, such as behavioral interventions, counseling, and treatment with medications, may be more appropriate for women.

Age and gender interact to create special needs for treatment of younger and older women. Girls and

young women are using drugs and alcohol at earlier ages, and larger numbers are becoming addicted. Traditional treatment programs, which are based on biological and behavioral aspects of men, do not necessarily work well for females. There is new evidence that, for physiological reasons, women may become addicted more easily than men.

Older women also need special consideration. Substance abuse among older women—particularly of alcohol and prescription drugs—is becoming one of the fastest growing health problems in the United States. Sometimes called the “invisible epidemic,” the trend disproportionately affects older women, as evidenced by a 43% increase in admission to treatment centers by women age 55 and older, compared to a 25% increase by men. Insufficient data and awareness of health providers, peer disapproval, and individual shame have kept the issue invisible and created barriers to treatment.

Physical activity is an important factor in women's health that has only recently received the attention of clinicians and researchers. Integrating physical activity in early childhood is an important step in building a healthy lifestyle, and maintaining regular physical activity into midlife and beyond reduces the risk of age-related diseases such as heart disease, hypertension, colon cancer, and diabetes. Despite the benefits of physical activity, only about 27% of women participate in recommended levels of physical activity, and 70% exercise irregularly or not at all.

Findings on physical activity over the life span indicate erosion of regular vigorous physical activity from adolescence through young adulthood, with the sharpest decline between ages 15 and 18 years. Erosion continues through the 20s before stabilizing during midlife. At age 65 and beyond, there is a stable-to-slight increase in physical activity until late life. Most important, at all points during the life span, females report much lower rates of regular sustained activity as compared to males. The differences in vigorous physical activity are especially large between adolescent boys and girls in vigorous activity.

## SOCIETAL INFLUENCES ON WOMEN'S HEALTH

Societal and cultural norms and socialization to gender roles are inextricably linked to women's health. Traditionally, these norms and roles suggest a way of life in which females are more responsible for

care of the home and other people than providing for their own economic security. This makes women dependent on someone else who is in control of the income and has the power that accompanies this. Education and economic realities of recent times have done much to empower women with respect to role flexibility and a place in the workforce. However, traditional gender roles are deeply ingrained, and although most women work outside the home, they still bear primary responsibility for work inside the home and care of dependent others—including their children, the ill, and the elderly. Despite the expansion of “women's work,” women—and their children—are still the most impoverished members of our society. It is not surprising, then, that the traditional focus on care of others rather than self-care, devotion to unpaid work, and poverty—each and collectively—takes a toll on women's health.

Attention to preventive health practices and self-care of health problems suffer because of role responsibilities. Women are more likely than men to report reduced control over daily decisions to practice healthy behaviors, such as regular exercise. Even women with chronic illness have difficulty attending to their own self-care needs because of their response to the needs of others. Women not only provide more care for others, they also report more burden from the caregiving experience. Burdensome outcomes of caregiving in women include declines in physical and emotional health, social isolation, and loss of income due to reduction in work hours or giving up paid work in order to provide care.

Finally, poor and minority women experience the most extreme threats to healthy living. Poor women, and their children, are at increased risk for inadequate nutrition and preventive health care as well as untreated and undertreated chronic disease. They are disproportionately exposed to substance abuse and the risk of injury due to crime and violence. Also, chronic stress associated with poor housing, dangerous neighborhoods, and financial insecurity are potent stressors that predict emotional and physical health problems. The highest number of depressive symptoms are found in unemployed poor women who are raising children without adequate social support.

## VIOLENCE AGAINST WOMEN

While violence is a problem throughout our society, it affects men and women differently. Men are

more likely to be victims of violent crime, but women are more likely to be assaulted, raped, or murdered by a current or former intimate partner. Violence can include physical or sexual assault, verbal abuse, threats, and social isolation. Violence against women has a number of repercussions for the woman, her children, and her family. In addition to the physical consequences of violence, victims of sexual assault are more likely to receive a psychiatric diagnosis of major depression, obsessive-compulsive disorder, or posttraumatic stress disorder and to suffer from alcohol and other substance abuse. Children are also affected by violence. Studies have shown that children who have witnessed violence show long-term behavioral effects and may show signs of posttraumatic stress disorder. Health care providers are increasingly being encouraged to conduct routine screenings for signs of violence.

## PROCESSES

### Research Participants and Health Care Policy

Who gets included in research is an important issue because research findings influence treatment and health care policy. It has been well documented that for many years women were underrepresented in research. Consequently, research was based on male subjects and then simply "applied" to women. However, we are now learning that because of differences in physiology and biology, women do not necessarily respond to diseases and treatments in the same way as men. For example, women with myocardial infarction present with different symptoms than men, and women respond differently to drugs such as potassium channel blockers as well as to chemotherapy.

As we begin to understand the importance of including women in research, we need to keep in mind that women cannot be considered a homogeneous group. In particular, as described throughout this entry, there are numerous differences in the health concerns of minority and majority women. African American women have a lower life expectancy than White women and have higher mortality rates for a number of diseases and conditions. For example, for women ages 25 to 44 years, HIV is the third leading cause of death among African American women, the fourth leading cause among Hispanic women, but is the tenth cause of death among White women. Although mortality rates due to HIV declined during

the 1990s, chiefly due to improved therapies, this decline has been greater in men than in women.

Recognizing the importance of women's health issues, in 1990 the National Institutes of Health (NIH) established the Office of Research on Women's Health (ORWH). The ORWH has a broad mandate that includes enhancing research related to diseases, disorders, and conditions that affect women, ensuring that research conducted by the NIH adequately address issues regarding women's health, and ensuring that women are appropriately represented in NIH-funded research. The NIH is now making a concerted effort to ensure that women and minorities are included in research. However, recruitment can still be a problem, particularly with respect to minorities and rural populations. Often these women are not reached through traditional recruitment methods, do not have access to clinical trial sites, or have logistical issues that make participation difficult.

## VARIABLES AND MEASURES

Another important issue concerns how we measure important concepts. In the behavioral and social sciences, many of our measures are based on self-report. We often use measures and concepts such as physical activity, social support, stress, depression, coping, quality of life, and Type A behavior. We need to ensure that these measures are appropriate for both men and women and people across ethnic groups. Often, measures developed for one population may not be valid for another. For example, when asking about physical activity, we need to ensure that specific items and activities are ones that both men and women engage in.

## CONCLUSIONS

Women's health issues have clearly extended beyond reproductive-related concerns. We are increasingly learning how sex and gender influence health and behavior. It is critical that we understand and appreciate these differences as we continue to conduct research, provide treatment, and formulate policy.

—Nancy E. Avis, Laura Coker,  
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*See also* AFRICAN AMERICAN HEALTH AND BEHAVIOR; AIDS  
AND HIV: PREVENTION OF HIV INFECTION; AUTOIMMUNE

DISEASES; PSYCHOSOCIAL ASPECTS; EATING DISORDERS;  
GENDER DIFFERENCES IN HEALTH; LOW BIRTH WEIGHT;  
PSYCHOSOCIAL ASPECTS; PREGNANCY OUTCOMES;  
PSYCHOSOCIAL ASPECTS; PREGNANCY PREVENTION IN  
ADOLESCENTS; VIOLENCE PREVENTION

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## WORK-RELATED STRESS AND HEALTH

### SHIFT WORK

In this entry, shift work, including night shifts, means a rotating schedule that includes work at night

and during daytime. In modern shift work schedules, the most common solution is to change working hours over successive working days so rapidly that a long-term shift to a biological night schedule is never achieved. Such a rotation requires considerable biological adaptation. If the body has not adapted to work at night, it tries to keep the brain awake by increasing activity in the sympathoadrenomedullary system and other similar energy-mobilizing systems. On the other hand, it is also difficult to fall asleep during day hours when the biological clock promotes a high level of energy. This means reduced sleep, which results in fatigue the next day. To compensate for this fatigue, the body has to increase the energy level that day, for example, by increasing the excretion of adrenaline and noradrenaline. A constant sleep deficit may result. It is important to organize shift schedules in a way that corresponds as closely as possible to the body's needs. Possibilities for recuperation must be provided after periods of excessive night work.

A difficult problem in research on health effects of shift work is that there are strong selection effects. This means that workers who easily adapt themselves to shift work, including night shifts, will tend to stay in such work, whereas those who have difficulties will tend to "select themselves out." Particularly after many years, this may result in an attenuation of the observed effect of such work on the risk of developing myocardial infarction. One of the first prospective studies in the field (Knutsson, Akerstedt, Jonsson, & Orth-Gomer, 1986) may have suffered from this problem. A group of industry workers were followed for more than 20 years with regard to morbidity and mortality. The findings indicated that there was a significant association between exposure to such shift work up to 20 years. After a longer period of exposure, no association was found. Quite to the contrary, an inverse relationship was observed. The most obvious explanation may be that workers who have stayed in this kind of work for over 20 years stand shift work unusually well. After such long periods, it may therefore be impossible to measure the true effect of shift work, including night shifts, on health risks.

There is increasing convergence in opinion among epidemiological researchers that shift work is associated with increased risk of developing myocardial infarction. A number of recently published epidemiological studies have shown effects in the order of 1.4 (which means 40% excess risk associated with exposure) even when adjustment has been made for possible

confounders (factors that are associated both with shift work and with cardiovascular illness risk—such factors may create spurious associations) such as serum lipids, blood pressure, smoking habits, overweight, social class, and educational level. One reason for this association could be that shift workers have a more unfavorable psychosocial job situation with regard to “job strain” (the combination of high psychological demands and low decision latitude; see Job Strain and Health in this volume) or imbalance between effort and reward at work (see Effort-Reward Imbalance in this volume). Adjustment for job strain did not change the association between shift work (including night shifts) and myocardial infarction risk, whereas adjustment for effort-reward imbalance did. Hence, it is not likely that the association is mediated by job strain but it could be partly mediated by effort-reward imbalance.

Two different possible pathways for the association between shift work, including night shifts, and cardiovascular disease have been discussed:

1. *Effects of shift work on personal habits of significance to cardiovascular illness risk.* Such effects may include effects on tobacco consumption, physical exercise, and eating habits. Shift workers have been observed in many studies to smoke more than other workers. It has been speculated that this may be due to the fact that shift workers have difficulties in staying awake and use tobacco as a stimulant. Shift work, which is prevalent among drivers, may prevent regular physical activity. Access to healthy food may also be limited in shift work. While all these factors may contribute to excess risk, they do not seem to explain all of it, since adjustment for them does not eliminate all of the risk associated with shift work, including night work.

2. *Direct effects of disturbed regulation of endocrine systems.* As mentioned above, the body tries to compensate for lack of sleep by increasing the activity in the sympathoadrenomedullary system, mainly the excretion of adrenaline and noradrenaline. This may have effects by itself, including increased coagulation, which may accelerate the atherosclerosis process. Lack of sleep is known to increase the risk of developing diabetes, which may also accelerate atherosclerosis. The body's ability to metabolize lipids and carbohydrates is weakened at night, and hence there is a possibility that food with a high content of fat and

carbohydrates may have more adverse effects on cardiovascular illness risk in shift workers than in others.

## LONG WORKING HOURS

In early epidemiological studies performed in the 1950s and 1960s, a relationship between long working hours (mostly above 70 hours per week) and risk of developing myocardial infarction early in life was shown. One of these was the cohort study of the U.S. Bell Telephone Company by Hinkle et al., which showed that men working full time and at the same time going to night college had an elevated risk of dying a coronary death. A Swedish study from this period showed that owners of small shops who had very long working weeks had an excess risk of developing myocardial infarctions. Kornitzer et al. showed that bank employees working in a state-owned bank system had a lower risk of developing myocardial infarction than bank employees in private banks. During later years, very few studies have been published on the relationship between long working hours and myocardial infarction risk. The small number of publications could be due either to lack of interest among researchers (which is unlikely) or to lack of positive findings in studies exploring this relationship. It could be that it has become increasingly difficult for participants in questionnaire studies to respond to questions about number of working hours. Leisure-time activities are more and more often mixed with paid work, for example, due to increased homework facilitated by small computers. A Japanese study of male office workers in 1998 showed that men both with low (equal to or less than 7 hours of work per day) and high (more than 11 hours of work per day) numbers of working hours had elevated risks of developing myocardial infarction. It could be suspected that men with a low number of working hours have reduced their working hours due to illness, but the authors argued that the design of their study made this explanation unlikely. Instead, they point at the fact that working a low number of working hours could be caused by financial crisis and could cause loss of self-esteem and anxiety, which could per se cause increased risk.

It could be argued that in future studies, the number of working hours should not be studied as a single factor. Being forced by someone else to work long hours and to work long hours in boring work that requires a high level of vigilance all the time (for example, taxi

or truck driving) is much more dangerous to health than working long hours in joyful work that one does voluntarily. One also has to combine the information regarding number of working hours with information about unpaid work, for example, in household work. A study by our group published in 1985 pointed in this direction. It was based on all male and female employees in four counties in Sweden. For each person, there was information regarding job title (three-digit international code, Nordic version). For each one of these occupation titles, there was information from national surveys regarding the distribution of responses to questions about working conditions. This made it possible to impute information regarding the "typical working conditions" for the individual's occupation. It was, for example, possible to identify individuals who were working in occupations in which at least 10 hours of overwork per week were common. Such individuals were compared with others with regard to risk of hospitalization during a 1-year follow-up.

Men working in "typical overtime work occupations" had a lower incidence and women working in such occupations a higher incidence of hospitalization for myocardial infarction than others. The reason for this discrepancy in findings between men and women could be either women's double role (paid and unpaid work) or differences in women's and men's labor market. The double role means that even moderate overtime could create an unbearable total workload. The difference in men's and women's labor market is of relevance, because women more frequently than men work in jobs with low decision latitude. Accordingly, overtime work may often be involuntary. The combination of long working hours and low decision latitude may be particularly hazardous to health. The effect of the double workload in women was studied in 199 Canadian women whose blood pressure was monitored by means of fully automated equipment during work hours, leisure hours, and sleep. This study, which was published in 1999, indicated that women who reported both job strain and strenuous family conditions had higher blood pressure at work, during leisure, and during sleep than other women.

## PROFESSIONAL DRIVING

In some studies, professional drivers have been shown to have a higher myocardial infarction incidence than other occupational groups. After adjustment for

possible confounders, the findings have only been consistent for inner-city bus drivers, however. Unhealthy diet, lack of physical exercise, Type A behavior, and adverse psychosocial conditions have been discussed as possible underlying etiological factors. Among psychosocial factors, job strain (high demands and lack of decision latitude; see Job Strain and Health in this volume) and imbalance between effort and reward (see Effort/Reward Imbalance in this volume) have been discussed. One important factor in professional driving is that there is constant vigilance and more or less conscious avoidance of threats. This is particularly common in inner-city traffic, where there are many unexpected and uncontrollable events around the bus, with pedestrians, bicyclists, and car drivers doing unexpected and potentially dangerous things. The driver has to have a high level of attention in order to be able to act adequately in all these situations. Studies have shown that such long-lasting hyperaroused states have adverse effects on the central nervous (electroencephalogram and evoked potentials) and cardiovascular systems (blood pressure and heart rate).

An additional possibly relevant factor that has been insufficiently studied in relation to the bus driver work is the relationship with passengers who may sometimes pose threats.

Other kinds of professional driving have also been studied in relation to the risk of developing cardiovascular disease. In some studies, taxi drivers as well as truck drivers have been found to have excess risk of developing cardiovascular disease, but these findings have been less consistent.

—Töres Theorell

See also EFFORT-REWARD IMBALANCE; JOB STRAIN AND HEALTH

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## WORKSITE HEALTH PROMOTION

Worksite health promotion includes programs, policies, and other initiatives based in worksites aimed at the promotion of workers' health. As such, worksite health promotion may include efforts to (a) reduce risk-related behaviors, such as tobacco use, unhealthy dietary patterns, physical inactivity, or sun exposure; (b) reduce risk-related exposures at work, such as to environmental tobacco smoke, occupational hazards, or job stressors; and (c) increase utilization of screening for early detection of disease, including, for example, screening for high blood pressure or high cholesterol, or mammography or Pap screening.

Worksites are an important channel for influencing the health of a large proportion of the adult population. Since the 1980s, the number of organizations offering worksite health promotion programs has grown rapidly. In 1999, approximately 90% of companies employing at least 50 workers reported offering at least one health promotion program for their employees in the last 12 months.

Worksite health promotion may focus on all workers and/or seek to identify and intervene with high-risk employees. There is some evidence pointing to the cost-effectiveness of programs targeting high-risk employees. From a public health perspective, the *impact* of an intervention is a product of both its *efficacy* in changing behavior and its *reach*, meaning the proportion of the population reached either through their direct participation or indirectly through diffusion

of intervention messages throughout the worksite. Worksite-wide programs designed to reach a broad audience within the worksite are likely to create an overall climate supportive of worker health. Individualized risk reduction counseling of high-risk employees is likely to be most effective when conducted in the overall context of a worksite health promotion effort for all employees.

The evolution of worksite health promotion programs has progressed through several generations. Early efforts often were conducted in response to safety regulations, or for similar reasons, and commonly were delivered in a lecture format with minimal employee input. Programs then progressed to a stage where they were focused on a single risk factor or behavior and were designed to reach one population. Later programs offered an array of interventions aimed at a variety of risk factors or behaviors for all employees. Recent efforts focus on comprehensive approaches that incorporate all activities, policies, and decisions related to the health of employees, their families, and the communities in which they reside. Several reviews of worksite health promotion have suggested that the most efficacious programs are those that are comprehensive, which means they provide multiple and coordinated interventions, offered in a coherent, ongoing program, focus on both workers and management, and address multiple levels of influence on worker and workplace health.

Effective comprehensive programs generally are based on strong theoretical foundations. A range of theoretical frameworks has suggested that worker health is the result of a complex interplay of factors involving individual workers and their immediate work environments, as well as characteristics of the larger contexts in which both the individual worker and the worksite are embedded. The social ecological model provides a structure for understanding and intervening on these multiple levels of influence. Accordingly, worksite health promotion programs aim to promote healthful change among individual workers, build social support and social norms that support healthful behavior, engage management in ensuring a healthful work environment, involve workers' families in health-promoting activities, and provide links to community and public policy initiatives that support health-promoting behaviors and organizations. This model provides a framework for moving beyond the individual as the locus of intervention and responsibility for health, recognizing the central roles



of management, unions, coworkers, families, and public policy initiatives in engaging in healthful behaviors that lead to reduced chronic disease risk. Thus, comprehensive worksite health promotion programs require coordinated efforts at the individual, interpersonal, and organizational levels.

#### INTERVENING AT THE INDIVIDUAL LEVEL

For maximum reach, interventions for individuals must be designed for workers at varying stages of readiness to change their health behavior. A comprehensive program needs to provide a full spectrum of activities, ranging from minimal interventions for workers not yet ready to make significant investments in health behavior change, to incentives and competitions, to group programs that build skills for change, provide counseling for high-risk workers, and are a source of social support for change. Increasingly, health promotion programs are moving away from a one-size-fits-all approach to interventions for individuals, to utilize “tailored” approaches. Tailoring provides a method for addressing the unique needs, interests, and concerns of participants, thus providing health education that is salient to the individual and more likely to lead to health behavior change. In the tailoring process, participants complete an assessment that elicits information such as sociodemographic characteristics, stage of readiness for behavior change, current health behavior status, and personal facilitators and barriers of health behavior change. These factors are fashioned into health messages, which are compiled into tailored feedback reports that are conveyed to individual participants in print or electronic media. Because it is possible to automate the tailoring process, it is now feasible to reach large numbers of people with personalized risk reduction messages. Interventions must also address structural barriers influencing worker participation. For example, blue-collar workers are less likely than white-collar workers to participate in health promotion programs. To increase participation, it may be necessary to garner supervisor support or incorporate interventions with management to reduce exposures to occupational hazards.

#### INTERVENING AT THE INTERPERSONAL LEVEL

Interventions at the interpersonal level include promoting coworker, supervisor, and family social

support and worksite social norms supportive of employee health. For example, buddy systems and peer support groups have been shown to enhance the effectiveness of worksite wellness programs. Similarly, peer-led programs may provide a strategy for dissemination of health information, a source of role models for behavior change, and a means of fostering positive social norms. Programs that build family support for health behavior change have been shown to be effective in promoting the adoption of healthy eating patterns. Social norms and social support, from both coworkers and supervisors, are also important in workers’ compliance with protective recommendations. The social contexts in which workers live and work also influence their health behaviors and the effectiveness of interventions. For example, it is important to understand and incorporate into program planning ways in which time on the job is structured, the meaning attached to health behaviors within one’s work group, and work stressors.

#### INTERVENING AT THE ENVIRONMENTAL/ORGANIZATIONAL LEVEL

Policies supporting worker health include those influencing the work environment and the organization of work. The work environment directly influences worker health through the presence of health-compromising exposures, such as exposures to occupational hazards or environmental tobacco smoke, and by the access to health-promoting environments, such as cafeterias that serve healthful foods or fitness facilities. Also, work environments may shape social norms associated with worker health. Job characteristics and the organization of work are also important correlates of worker health. For example, there is strong evidence that job strain is a risk factor for heart disease and is associated with smoking, sedentary behavior, and other deleterious health outcomes. Assessment of job content and job design may lead to necessary changes in the organization of work, and are important elements of a range of worksite interventions.

Interventions at the organizational level must involve key stakeholders, including management, workers, and unions. Management sets the direction for worker health, either through clear statements of priorities or through tacit understandings transmitted through administrative hierarchies. Management support may be reflected in corporate mission statements,

worker participation in health and safety committees, and the extent to which employees are afforded the flexibility necessary to participate in worksite health promotion programs. All of these factors have been associated with positive health behavior. Management support also serves to sustain and institutionalize programs over the long term. To observe change in health outcomes, programs must be of sufficient duration to provide ongoing, persistent messages supporting health.

In unionized worksites, unions provide a voice for workers. Labor-management relationships, however, are likely to influence workers' response to health promotion programs, and need to be addressed by program planners. If labor-management relationships are strained and programs are perceived by workers to be closely aligned with management, union members may view them with skepticism. Historically, unions have espoused a philosophy that members' private lives are not the prerogative of management. This belief may have an impact on the way union members respond to workplace programs that address personal health behaviors. In addition, unions have expressed concern that health promotion programs may draw attention away from the competing needs to address workplace risks. Another concern expressed by some union members is that health promotion efforts may enter into areas that traditionally have been reserved for collective bargaining, thus taking power and control away from the union. There are effective approaches to overcoming these potential barriers. Researchers have found that in worksites that offer health programs addressing occupational health as well as health promotion, blue-collar workers are more likely to participate in program activities and have higher rates of smoking cessation than programs that address only health promotion. When unions are represented at the table along with management to plan and implement programs and policies and their voices are heard, unions are likely to support programs that benefit the health of their members. For example, a recent study of organized labor's positions on worksite tobacco control policies found that nearly 50% of the local unions surveyed supported worksite smoking bans or restrictions and only 8% actively opposed them. When unions have grieved worksite smoking policies, the most common reason has been that policies were unilaterally imposed by management without involvement of the union.

Worker participation in planning can ensure that interventions respond to worker needs and priorities.

Programs are likely to be more effective when they are based on an understanding of workers' concerns about health risks on the job. Also, participatory methods are important as a basis for educational strategies. Use of learner-centered models can build a sense of worker control, which goes beyond transmission of information and skills, and may facilitate joint problem solving. These methods may be health enhancing in and of themselves.

In summary, the current evidence points to the feasibility and potential efficacy of worksite health promotion programs. Much research to date has tested intervention "packages," making it difficult to disentangle the effects of specific intervention components. Future research can help to identify those program elements that hold particular promise within a range of work settings and with differing types of workers. Programs to date have been less successful with low-income, less-educated workers than with middle and upper income, well-educated workers. Future research needs to attend to social disparities in health; to recognize demographic changes in the U.S. workforce, such as the increasing diversity by race/ethnicity and aging; and to understand the changing nature of work within the United States. Future worksite health promotion programs need to be designed to respond to these changes.

—Glorian Sorensen and Mary Kay Hunt

See also HEALTH COMMUNICATION; HEALTH PROMOTION AND DISEASE PREVENTION; OBESITY: PREVENTION AND TREATMENT; PHYSICAL ACTIVITY INTERVENTIONS; TAILORED COMMUNICATIONS

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## WOUND HEALING AND STRESS

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Damage to any soft or hard tissue is followed by an ordered set of events aimed at restoring tissue function and integrity. Injured tissues heal by partial or complete regeneration or by repair. Regeneration implies complete reestablishment of the original tissue structure. Repair results in replacement with scar tissue that is structurally and functionally inferior to the original tissue. Although there can be substantial diversity in the type and severity of wounds, healing is typically divided into three general phases that overlap considerably. These are the inflammatory, proliferative (new tissue generation), and remodeling phases.

The first phase or inflammatory phase begins immediately after injury. This inflammatory phase is the localized response elicited by injury and destruction of tissues, and serves to remove or wall off both the injurious agent and the injured tissues. This inflammatory phase begins almost immediately upon wounding with the accumulation of platelets to establish a clot to limit blood loss and limit further tissue injury. Also within the first minutes after wounding, neutrophils are recruited to the wound to control infection. The inflammatory environment stimulates the release of toxic reactive oxygen intermediates from neutrophils. These reactive oxygen intermediates include substances such as hydrogen peroxide and are toxic to invading bacteria and fungi. Once bacterial contamination has been controlled, neutrophils become entrapped within the clot or are ingested and thus removed by macrophages that follow into the wound to begin the reparative process. Wound macrophages continue to eliminate deleterious materials, generate substances called chemotactic factors that recruit additional inflammatory cells to the injury site, and release collagenases, which are degrading enzymes that digest and remove dead or nonviable material. Wound macrophages also synthesize growth factors that stimulate new tissue formation.

These growth factors include platelet-derived growth factor, transforming growth factor-beta, fibroblast growth factors, and interleukin-1. Once the macrophage begins to produce these growth factors, the next phase of wound healing begins.

The second phase of wound healing is the proliferative phase. In cutaneous wounds, it is characterized by reepithelialization and granulation tissue formation. Reepithelialization is the reconstitution of the cells of the epidermis in order to cover the injured site and restore barrier function. Granulation tissue formation consists of fibroplasia and angiogenesis and occurs in the healing of all wounded tissues. Fibroplasia is the process of fibroblast recruitment into the wound site and the ensuing synthesis and secretion of a temporary extracellular matrix of structural collagens and space-filling sugars (i.e., glycosaminoglycans and proteoglycans). The extracellular matrix and the cells within it give a tissue its physical structure and provide for its function. The provisional and immature matrix produced during the proliferative phase provides for temporary scaffolding upon which the wound heals. It will be gradually replaced with a mature and organized extracellular matrix. Angiogenesis is the process of new blood vessel formation, and it occurs simultaneously with fibroplasia, commencing within days of injury. The assembly of a dense network of capillaries in the healing scar helps provide the energy and nutrients necessary for the proliferation of fibroblasts, the production of large quantities of provisional matrix, and the secretion of growth factors by macrophages. As this new tissue is forming, contraction begins to lessen the size of the wound. Wound contraction is the reduction in the defect by centripetal movement (i.e., movement toward the center) of the surrounding undamaged skin.

The third and final phase of wound healing, the remodeling phase, begins soon after the first molecules of connective tissue are produced during the previous phases. The provisional matrix or granulation tissue that is produced during the proliferative phase is immature and poorly organized. In an attempt to regenerate the characteristics of the original tissue, provisional matrix molecules are progressively replaced by mature forms of collagens and proteoglycans. Remodeling is normally considered the final phase of wound healing because it continues for months to years after granulation tissue has been resolved. Through remodeling, the highly cellular and

highly vascular granulation tissue is gradually replaced, forming scar tissue, which is less cellular and less vascular than the temporary granulation tissue. Although repaired tissues will not be identical to the original, the resultant remodeled matrix should resemble it in both strength and function, whether it is bone, skin, liver, or any other type of tissue.

When these three stages proceed normally, wounds heal without serious consequences to the host. However, the timing of each event during the phases of healing is important, as each component is dependent on the one that came before. Therefore, influences at any of these stages could impact the healing process and delay wound closure. Behavioral stress is one of those influences that alter healing. Studies in both animals and humans have shown that psychological stress (e.g., emotional distress, depression, anxiety, helplessness) can delay the closure of small cutaneous wounds by several days. Psychological and behavioral stressors reduce the onset and magnitude of the inflammatory phase of healing as the production of proinflammatory factors is diminished in stressed subjects. Thus, the recruitment of neutrophils and macrophages is diminished as well as their ability to kill and remove microorganisms. This results in impaired bacterial elimination and delayed wound debridement (i.e., removal of dead, devitalized, or contaminated tissue). Not only is the inflammatory phase affected, but every step along the way to scar maturation can be altered by stress. For example, reepithelialization is impaired as keratinocyte proliferation is delayed. In addition, fibroblast proliferation, the production of the provisional matrix, and angiogenesis are all diminished in the wounds of stressed subjects. Consequences due to this delay include a prolonged chance for bacterial contamination of the open wound.

How does stress slow wound healing? Psychological stressors activate a bodywide set of physiologic adaptations mediated primarily by the hypothalamic-pituitary-adrenal axis through the production of glucocorticoids (e.g., cortisol and corticosterone) and by the sympathetic nervous system via the production of catecholamines (e.g., epinephrine and norepinephrine). These neuroendocrine systems regulate many components of the healing cascade. For example, the use of exogenous glucocorticoids in the clinic has been associated with increased risk of wound contamination and delayed healing of open wounds. Glucocorticoids produce these effects by interfering

with inflammation, fibroblast proliferation, collagen synthesis and degradation, angiogenesis, wound contraction, reepithelialization, and remodeling. Glucocorticoids, whether exogenously administered by a physician or endogenously elevated due to psychological stress, regulate the expression of various genes at the wound site that encode key players in each of these wound repair processes. For example, proinflammatory cytokines (interleukin-1 and tumor necrosis factor alpha), growth factors (keratinocyte growth factor, transforming growth factor beta, and platelet-derived growth factor), and remodeling enzymes (macrophage- and fibroblast-derived matrix metalloproteinases) are targets of glucocorticoid action in wounded skin.

—David A. Padgett

*See also* ALLOSTATIS, ALLOSTATIC LOAD, AND STRESS;  
CAREGIVING AND STRESS; IMMUNE RESPONSES TO STRESS;  
PSYCHONEUROIMMUNOLOGY; STRESS: BIOLOGICAL ASPECTS

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# Appendix A

## Online Resources and Health and Behavior Organizations

Agency for Healthcare Research and Quality  
2101 E. Jefferson Street, Suite 501  
Rockville, MD 20852  
Telephone: 301-594-1364  
<http://www.ahrq.gov/>

According to its Web site, the “mission of the Agency for Health Care Policy and Research is to support, conduct, and disseminate research that improves access to care and the outcomes, quality, cost, and utilization of health care services. The research sponsored and conducted by the Agency provides better information that enables better decisions about health care” (in 1999, the Agency for Health Care Policy and Research changed its name to the Agency for Healthcare Research and Quality, AHRQ).

Alan Guttmacher Institute  
120 Wall Street, 21st Floor  
New York, NY 10005  
Telephone: 212-248-1111  
[www.agi-usa.org/](http://www.agi-usa.org/)

The Alan Guttmacher Institute is a nonprofit organization focused on sexual and reproductive health research, policy analysis, and public education. The institute’s mission is to protect the reproductive choices of all women and men in the United States and throughout the world. It is to support their ability to obtain the information and services needed to achieve their full human rights, safeguard their health, and exercise their individual responsibilities in regard to sexual behavior and relationships, reproduction, and family formation.

Alzheimer’s Association  
225 North Michigan Avenue, Suite 1700  
Chicago, IL 60601-7633  
Telephone: 312-335-8700  
<http://www.alz.org/>

The Alzheimer’s Association, a national network of chapters, is the largest national voluntary health organization dedicated to advancing Alzheimer’s research and helping those affected by the disease. Having awarded \$136 million in research grants, the association ranks as the top private funder of research into the causes, treatments, and prevention of Alzheimer’s disease. The association also provides education and support for people diagnosed with the condition, their families, and caregivers.

American Academy of Child and Adolescent Psychiatry  
3615 Wisconsin Avenue N.W.  
Washington, DC 20016-3007  
Telephone: 202-966-7300  
<http://www.aacap.org>

The American Academy of Child and Adolescent Psychiatry (AACAP) is a membership-based organization, composed of more than 6,500 child and adolescent psychiatrists and other interested physicians. Its members actively research, evaluate, diagnose, and treat psychiatric disorders and pride themselves on giving direction to and responding quickly to new developments in addressing the health care needs of children and their families.

American Academy of Nursing  
600 Maryland Avenue, S.W., Suite 100 West  
Washington, DC 20024-2571  
Telephone: 202-651-7238  
[www.nursingworld.org/aan/](http://www.nursingworld.org/aan/)

The American Academy of Nursing is constituted to potentiate the contributions of nursing leaders in transforming the health care system to optimize public well-being. This leadership is grounded in a global perspective, enriched by diversity, and actualized through partnerships with other health care and consumer groups.

American Academy of Pediatrics  
141 Northwest Point Boulevard  
Elk Grove Village, IL 60007-1098  
Telephone: 847-434-4000  
<http://www.aap.org/>

The American Academy of Pediatrics (AAP) and its member pediatricians dedicate their efforts and resources to the health, safety, and well-being of all infants, children, adolescents, and young adults. The AAP has 57,000 members in the United States, Canada, and Latin America. Members include pediatricians, pediatric medical subspecialists, and pediatric surgical specialists. More than 41,000 members are board certified and are called Fellows of the American Academy of Pediatrics (FAAP).

American Association of Colleges of Nursing  
One Dupont Circle, N.W., Suite 530  
Washington, DC 20036  
Telephone: 202-463-6930  
<http://www.aacn.nche.edu/>

The American Association of Colleges of Nursing (AACN) is the national voice for America's baccalaureate- and higher-degree nursing education programs. AACN's educational, research, government advocacy, data collection, publications, and other programs work to establish quality standards for bachelor's- and graduate-degree nursing education, assist deans and directors to implement those standards, influence the nursing profession to improve health care, and promote public support of baccalaureate and graduate education, research, and practice in nursing.

American Association of Spinal Cord Injury Psychologists and Social Workers  
75-20 Astoria Boulevard  
Jackson Heights, NY 11370

Telephone: 718-803-3782  
<http://www.aascipsw.org/>

The American Association of Spinal Cord Injury Psychologists and Social Workers (AASCIPSW) is an organization of psychologists and social workers who provide for the emotional, behavioral, and psychosocial care of persons affected by spinal cord impairment (SCI). AASCIPSW, incorporated in 1986, operates exclusively for scientific, charitable, and educational purposes. AASCIPSW provides members the opportunity to develop and refine leadership skills through active participation in the association.

American Association of Suicidology  
4201 Connecticut Avenue, N.W., Suite 408  
Washington, DC 20008  
Telephone: 202-237-2280  
[www.suicidology.org/](http://www.suicidology.org/)

The goal of the American Association of Suicidology (AAS) is to understand and prevent suicide. AAS promotes research, public awareness programs, public education, and training for professionals and volunteers. In addition, AAS serves as a national clearinghouse for information on suicide. The membership of AAS includes mental health and public health professionals, researchers, suicide prevention and crisis intervention centers, school districts, crisis center volunteers, survivors of suicide, and a variety of laypersons who have an interest in suicide prevention.

American Cancer Society  
<http://www.cancer.org>  
Telephone: 1-800-ACS-2345

The American Cancer Society (ACS) is a nationwide, community-based voluntary health organization. With chartered divisions throughout the country and more than 3,400 local offices, the ACS is committed to fighting cancer through balanced programs of research, education, patient service, advocacy, and rehabilitation.

American College of Preventive Medicine  
1307 New York Avenue, N.W., Suite 200  
Washington, DC 20005  
Telephone: 202-466-2044  
[www.acpm.org](http://www.acpm.org)

The American College of Preventive Medicine (ACPM) is the national professional society for physicians committed to disease prevention and health promotion.

American Counseling Association  
5999 Stevenson Avenue  
Alexandria, VA 22304  
Telephone: 1-800-347-6647  
[www.counseling.org](http://www.counseling.org)

The American Counseling Association (ACA) is a not-for-profit, professional and educational organization dedicated to the growth and enhancement of the counseling profession. Founded in 1952, ACA is the world's largest association exclusively representing professional counselors in various practice settings. ACA has been instrumental in setting professional and ethical standards for the counseling profession.

American Diabetes Association  
National Center  
1701 North Beauregard Street  
Alexandria, VA 22311  
Telephone: 1-800-DIABETES (1-800-342-2383)  
[www.diabetes.org](http://www.diabetes.org)

The American Diabetes Association is the nation's leading nonprofit health organization providing diabetes research, information, and advocacy. The mission of the organization is to prevent and cure diabetes and to improve the lives of all people affected by diabetes.

American Heart Association  
National Center  
7272 Greenville Avenue  
Dallas, TX 75231  
Telephone: 1-800-AHA-USA-1 or 1-800-242-8721  
[www.americanheart.org](http://www.americanheart.org)

The American Heart Association is a national voluntary health agency whose mission is to reduce disability and death from cardiovascular diseases and stroke.

American Institute of Stress  
124 Park Avenue  
Yonkers, NY 10703  
Telephone: 914-963-1200  
<http://www.stress.org/>

The American Institute of Stress is committed to developing a better understanding of how to tap into the vast innate potential that resides in each of us for preventing disease and promoting health.

American Psychiatric Association  
1000 Wilson Boulevard, Suite 1825

Arlington, VA 22209-3901  
Telephone: 703-907-7300  
[www.psych.org](http://www.psych.org)

The American Psychiatric Association is a medical specialty society recognized worldwide. Its 37,000 U.S. and international member physicians work together to ensure humane care and effective treatment for all persons with mental disorders, including mental retardation and substance-related disorders. It is the voice and conscience of modern psychiatry. Its vision is a society that has available accessible quality psychiatric diagnosis and treatment.

American Psychological Association  
750 First Street, N.E.  
Washington, DC 20002-4242  
Telephone: 1-800-374-2721 or 202-336-5500  
[www.apa.org](http://www.apa.org)

The American Psychological Association (APA) is a scientific and professional organization that represents psychology in the United States. With more than 155,000 members, APA is the largest association of psychologists worldwide. APA's initiatives include supporting psychology as a science, profession, and means to improve health and human welfare; educating the public and the media on the value of psychology; advocating in legislatures, educational settings, and major social institutions on behalf of the discipline and psychologists; and working to advance education and training in psychology from preschool to postdoctorate levels.

American Psychological Society  
1010 Vermont Avenue N.W., Suite 1100  
Washington, DC 20005-4907  
Telephone: 202-783-2077  
<http://www.psychologicalscience.org/>

The mission of the American Psychological Society (APS) is to promote, protect, and advance the interests of scientifically oriented psychology in research, application, teaching, and the improvement of human welfare. The APS is a nonprofit membership organization founded in 1988 to advance scientific psychology and its representation as a science on the national level. APS grew quickly, surpassing 5,000 members in its first 6 months. In 2003, APS membership exceeded 13,500 and includes the leading psychological scientists and academics, clinicians, researchers, teachers, and administrators.



American Psychosocial Oncology Society  
2365 Hunters Way  
Charlottesville, VA 22911  
Telephone: 434-293-5350  
[www.apos-society.org/](http://www.apos-society.org/)

The mission of American Psychosocial Oncology Society is to promote the psychological, social, and physical well-being of patients with cancer and their families at all stages of disease and survivorship through clinical care, education, research, and advocacy.

American Psychosomatic Society  
6728 Old McLean Village Drive  
McLean, VA 22101-3906  
Telephone: 703-556-9222  
[www.psychosomatic.org](http://www.psychosomatic.org)

The mission of the American Psychosomatic Society is to promote and advance the scientific understanding of the interrelationships among biological, psychological, social, and behavioral factors in human health and disease, and the integration of the fields of science that separately examine each, and to foster the application of this understanding in education and improved health care.

American Public Health Association  
800 I Street, N.W.  
Washington, DC 20001  
Telephone: 202-777-2742  
<http://www.apha.org/>

The American Public Health Association (APHA) is the oldest and largest organization of public health professionals in the world, representing more than 50,000 members from over 50 occupations of public health. APHA brings together researchers, health service providers, administrators, teachers, and other health workers in a unique, multidisciplinary environment of professional exchange, study, and action. APHA is concerned with a broad set of issues affecting personal and environmental health, including federal and state funding for health programs, pollution control, programs and policies related to chronic and infectious diseases, a smoke-free society, and professional education in public health.

American Social Health Association  
P.O. Box 13827  
Research Triangle Park, NC 27709  
Telephone: 919-361-8400  
<http://www.ashastd.org/>

The American Social Health Association is recognized by the public, patients, providers, and policymakers for developing and delivering accurate, medically reliable information about sexually transmitted diseases.

American Society for Clinical Nutrition  
9650 Rockville Pike  
Bethesda, MD 20814-3998  
Telephone: 301-530-7110  
[www.faseb.org/ascn/](http://www.faseb.org/ascn/)

The American Society for Clinical Nutrition (ASCN) is the clinical division of the American Society for Nutritional Sciences. The goals and objectives of the ASCN are to encourage and implement undergraduate and graduate education in basic and clinical nutrition, particularly in medical schools; expand research and clinical training opportunities in nutrition science for health professionals; and provide opportunities for investigators to present and discuss current research in human nutrition.

American Society for Nutritional Sciences  
9650 Rockville Pike, Suite 4500  
Bethesda, MD 20814  
Telephone: 301-530-7050  
[www.asns.org/](http://www.asns.org/)

The American Society for Nutritional Sciences is the premier research society dedicated to improving the quality of life through the science of nutrition.

American Sociological Association  
1307 New York Avenue, N.W., Suite 700  
Washington, DC 20005  
Telephone: 202-383-9005  
<http://www.asanet.org/>

The American Sociological Association (ASA) is a membership association dedicated to advancing sociology as a scientific discipline and profession serving the public good. With approximately 13,000 members, ASA encompasses sociologists who are faculty members at colleges and universities, researchers, practitioners, and students.

Association for Applied Psychophysiology and Biofeedback  
10200 W. 44th Avenue, Suite 304  
Wheat Ridge, CO 80033-2840, USA  
Telephone: 303-422-8436  
[www.aapb.org](http://www.aapb.org)

The mission of the Association for Applied Psychophysiology and Biofeedback (AAPB) is to advance the development, dissemination, and utilization of knowledge about applied psychophysiology and biofeedback to improve health and the quality of life through research, education, and practice. The goals of the association are to promote a new understanding of biofeedback and advance the methods used in this practice.

Association for the Advancement of Behavior Therapy  
305 7th Avenue, 16th Floor  
New York, NY 10001  
Telephone: 212-647-1890  
[www.aabt.org](http://www.aabt.org)

The Association for the Advancement of Behavior Therapy (AABT) is a professional, interdisciplinary organization that is concerned with the application of behavioral and cognitive sciences to the understanding of human behavior, developing interventions to enhance the human condition, and promoting the appropriate utilization of these interventions. AABT is a not-for-profit membership organization of more than 4,500 mental health professionals and students who are interested in behavior therapy and cognitive behavior therapy in order to gain a better understanding of human behavior; develop, assess, and apply interventions to assist in behavior change; help people deal with personal and social problems and issues; and further the empirical study, theory, and practice of these therapies.

Association of Behavior Analysis  
1219 South Park Street  
Kalamazoo, MI 49001  
Telephone: 269-492-9310  
<http://www.abainternational.org/>

The mission of the Association of Behavior Analysis is to develop, enhance, and support the growth and vitality of behavioral analysis through research, education, and practice.

Association of State and Territorial Directors of Health Promotion and Public Health Education  
1101 15th Street, N.W., Suite 601  
Washington, DC 20005  
Telephone: 202-659-2230  
[www.astdhpphe.org](http://www.astdhpphe.org)

The Association of State and Territorial Directors of Health Promotion and Public Health Education

(ASTDHPPE) was founded in 1946 (as the Conference of State Directors of Public Health Education) as a joint effort between directors of health education in state health departments and deans of health education in schools of public health. In 1994, the association changed its name to the Association of State and Territorial Directors of Health Promotion and Public Health Education to better reflect the mission and roles of the membership in promoting health and preventing disease in states and communities.

Association of Teachers of Preventive Medicine  
1660 L Street, N.W., Suite 208  
Washington, DC 20036  
Telephone: 202-463-0550  
<http://www.atpm.org/>

The Association of Teachers of Preventive Medicine (ATPM) is the national association supporting health promotion and disease prevention educators and researchers. Since 1942, ATPM and its members have been in the forefront of advancing, promoting, and supporting health promotion and disease prevention in the education of physicians and other health professionals.

Behavior OnLine  
[www.behavior.net/about.html](http://www.behavior.net/about.html)

Behavior OnLine aspires to be the premier World Wide Web gathering place for mental health professionals and applied behavioral scientists—a place where professionals of every discipline can feel at home.

Center for Behavioral Neuroscience  
[www.cbn-atl.org](http://www.cbn-atl.org)

The Center for Behavioral Neuroscience examines the neural mechanisms underlying the social behaviors that are essential for species survival, such as fear, affiliation, aggression, and reproductive behaviors.

Center for Communication Programs  
Johns Hopkins Bloomberg School of Public Health  
111 Market Place, Suite 310  
Baltimore, MD 21202  
Telephone: 410-659-6300  
[www.jhuccp.org/](http://www.jhuccp.org/)

The Center for Communication Programs (CCP) works with international agencies, foundations, governments, and nongovernmental organizations in the United States and overseas to promote healthy behavior.

The CCP's work focuses on the field of strategic, research-based communication for behavior change and health promotion that has helped transform the theory and practice of public health.

Center for the Advancement of Health  
2000 Florida Avenue, N.W., Suite 210  
Washington, DC 20009-1231  
Telephone: 202-387-2829  
[www.cfah.org/](http://www.cfah.org/)

The Center for the Advancement of Health promotes a view of health that recognizes that where we live, how we are educated, and what we eat, drink, breathe, and do affect health as much as, if not more than, access to health care. Its mission is to translate research on this expanded view of health into effective policy and practice.

Centers for Disease Control and Prevention  
1600 Clifton Road  
Atlanta, GA 30333  
Telephone: 404-639-3311  
[www.cdc.gov](http://www.cdc.gov)

The Centers for Disease Control and Prevention (CDC) is recognized as the lead federal agency for protecting the health and safety of people, at home and abroad, providing credible information to enhance health decisions and promoting health through strong partnerships. The CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States. The CDC's mission is to promote health and quality of life by preventing and controlling disease, injury, and disability.

College on Problems of Drug Dependence  
3420 N. Broad Street  
Philadelphia, PA 19140  
Telephone: 215-707-3242  
<http://www.cpdd.vcu.edu/>

The College on Problems of Drug Dependence (CPDD), formerly the Committee on Problems of Drug Dependence, has been in existence since 1929 and is the longest-standing group in the United States addressing problems of drug dependence and abuse. CPDD serves as an interface among government, industrial, and academic communities maintaining liaisons with regulatory and research agencies as well

as educational, treatment, and prevention facilities in the drug abuse field. It also functions as a collaborating center of the World Health Organization.

Commission on Accreditation of Rehabilitation Facilities  
4891 E. Grant Road  
Tucson, AZ 85712  
Telephone: 520-325-1044  
[www.carf.org](http://www.carf.org)

The Commission on Accreditation of Rehabilitation Facilities (CARF) is an independent, not-for-profit accrediting body promoting quality, value, and optimal outcomes of services through a consultative accreditation process that centers on enhancing the lives of the persons receiving services. Founded in 1966 as the Commission on Accreditation of Rehabilitation Facilities, the accrediting body is now known as CARF. The mission of CARF is to promote the quality, value, and optimal outcomes of services through a consultative accreditation process that centers on enhancing the lives of the persons served.

Consortium of Social Science Associations  
1522 K Street, N.W., Suite 836  
Washington, DC 20005  
Telephone: 202-842-3525  
<http://www.cossa.org/>

The Consortium of Social Science Associations (COSSA) is an advocacy organization supported by more than 100 professional associations, scientific societies, universities, and research institutions. COSSA stands alone in representing the full range of social scientists. COSSA represents the needs and interests of social and behavioral scientists; educates federal officials about social and behavioral science; informs the science community about relevant federal policies; and cooperates with other science and education groups in pursuit of common goals. COSSA lobbies Congress and the Executive Branch on issues affecting the social science portfolios of the National Science Foundation, the National Institutes of Health, the Departments of Agriculture, Commerce, Education, Justice, and Labor, and many other federal agencies.

Council of Graduate Departments of Psychology  
<http://psych.wfu.edu/cogdop/>

The Council of Graduate Departments of Psychology (COGDOP) is a society constituted of chairs and heads of departments of psychology or other equivalent administrative units, which are authorized to offer

graduate degrees in psychology in institutions accredited by their regional accrediting association. Membership is held by the department, not by the individual.

Decade of Behavior  
750 First Street, N.E.  
Washington, DC 20002-4242  
Telephone: 202-336-6166  
[www.decadeofbehavior.org](http://www.decadeofbehavior.org)

The Decade of Behavior, launched in September 2000, is a multidisciplinary initiative to focus the talents, energy, and creativity of the behavioral and social sciences on meeting many of society's most significant challenges. These include improving education and health care; enhancing safety in homes and communities; actively addressing the needs of an aging population; and helping to curb drug abuse, crime, high-risk behaviors, poverty, racism, and cynicism toward government.

Federation of Behavioral, Psychological and Cognitive Sciences  
750 First Street, N.E.  
Washington, DC 20002  
Telephone: 202-336-5920  
<http://www.thefederationonline.org/>

The Federation of Behavioral, Psychological and Cognitive Sciences is a dues-supported coalition of member organizations, university departments of psychology, schools of education, research centers, regional psychological associations, and science divisions of the American Psychological Association. The federation represents the interests of scientists who do research in the areas of behavioral, psychological, and cognitive sciences. The efforts of the federation are focused on legislative and regulatory advocacy, education, and the communication of information to scientists.

Gerontological Society of America  
1030 15th Street, N.W., Suite 250  
Washington, DC 20005  
Telephone: 202-842-1275  
<http://www.geron.org/>

The Gerontological Society of America (GSA) is a nonprofit professional organization with more than 5,000 members in the field of aging. GSA provides researchers, educators, practitioners, and policymakers with opportunities to understand, advance, integrate, and use basic and applied research on aging to improve the quality of life as one ages.

Healthfinder  
P.O. Box 1133  
Washington, DC 20013-1133  
[www.healthfinder.gov/](http://www.healthfinder.gov/)

Healthfinder is a guide to reliable health information from the Department of Health and Human Services. The guide includes a health library of hand-picked health information from A to Z—prevention and wellness, diseases and conditions, and alternative medicine—plus medical dictionaries, an encyclopedia, journals, and more.

Health Psychology, Division 38 of the American Psychological Association  
750 First Street, N.E.  
Washington, DC 20002-4242  
Telephone: 202-336-6013  
[www.apa.org/about/division/div38.html](http://www.apa.org/about/division/div38.html)

Division 38 seeks to advance contributions of psychology to the understanding of health and illness through basic and clinical research, education, and service activities and encourages the integration of biomedical information about health and illness with current psychological knowledge. The division has a nursing and health group and special interest groups in aging, women, and minority health issues. The division publishes the bimonthly journal *Health Psychology* and the quarterly newsletter *Health Psychologist*. Division 38 offers a listing of training programs in health psychology and presents an annual student paper award.

Human Factors and Ergonomics Society  
P.O. Box 1369  
Santa Monica, CA 90406-1369  
Telephone: 310-394-2410  
<http://www.hfes.org/>

The mission of the Human Factors and Ergonomics Society is to promote the discovery and exchange of knowledge concerning the characteristics of human beings that are applicable to the design of systems and devices of all kinds. The society was founded in 1957 as the Human Factors Society of America. Later, the name was changed to the Human Factors Society, Inc., to reflect its international influence and membership. In 1992, the name was changed to the Human Factors and Ergonomics Society.

Institute for the Advancement of Human Behavior  
4370 Alpine Road, Suite 209

Portola Valley, CA 94028  
 Telephone: 1-800-258-8411  
[www.iahb.org](http://www.iahb.org)

The Institute for the Advancement of Human Behavior (IAHB) is a fully accredited sponsor of continuing education and continuing medical education for mental health, chemical dependency, and substance abuse treatment providers in the United States and Canada. IAHB's mission is to provide high-quality clinical training to health care professionals as well as to companies and individuals with health care-related interests.

Institute for the Advancement of Social Work Research  
 750 First Street, N.E., Suite 700  
 Washington, DC 20002-4241  
 Telephone: 202-336-8385  
<http://www.iaswresearch.org/>

The Institute for the Advancement of Social Work Research (IASWR) is a Washington, D.C.-based nonprofit organization. IASWR works to improve the lives of vulnerable populations by advocating for the importance of research to strengthen the social work profession's capacity to address complex social needs, and to contribute to improved prevention and treatment interventions, services, and policies. The overarching, single mission of IASWR is to promote and strengthen research in the social work profession.

Institute of Medicine  
 The National Academies  
 500 Fifth Street, N.W.  
 Washington, DC 20001  
 Telephone: 202-334-2138  
[www.iom.edu/](http://www.iom.edu/)

The mission of the Institute of Medicine (IOM) is to advance and disseminate scientific knowledge to improve human health. The institute provides objective, timely, authoritative information and advice concerning health and science policy to government, the corporate sector, the professions, and the public. IOM is part of the National Academy of Sciences organizations and does not receive direct federal appropriations for its work. The National Academy of Sciences was created by the federal government to be an adviser on scientific and technological matters.

Intercultural Cancer Council  
 6655 Travis, Suite 322  
 Houston, TX 77030-1312

Telephone: 713-798-4617  
<http://iccnetwork.org>

The Intercultural Cancer Council (ICC) promotes policies, programs, partnerships, and research to eliminate the unequal burden of cancer among racial and ethnic minorities and medically underserved populations in the United States and its associated territories.

International Psycho-Oncology Society  
 2365 Hunters Way  
 Charlottesville, VA 22911  
 Telephone: 434-971-4788  
<http://www.ipos-society.org>

The International Psycho-Oncology Society (IPOS) was created to foster international multidisciplinary communication about clinical, educational, and research issues that relate to the subspecialty of psycho-oncology. The society seeks to provide leadership and development of standards for educational training and research in the two psychosocial dimensions of cancer: the response of patients, families, and staff to cancer and its treatment at all stages, and the psychological, social, and behavioral factors that influence tumor progression and survival. It has boundaries with all clinical oncologic specialties, epidemiology and cancer control, basic sciences, bioethics, palliative care, rehabilitation, clinical trials, and decision making.

International Social Science Council  
 UNESCO House  
 1, rue Miollis  
 75732 Paris Cedex 15, France  
<http://www.unesco.org/ngo/issc/sommaire.htm>

The International Social Science Council (ISSC) is an international nonprofit scientific organization with its headquarters in UNESCO House in Paris. The ISSC has as its aims and objectives the promotion of the understanding of human society in its environment by fostering the social and behavioral sciences throughout the world and their application to major contemporary problems and by enhancing cooperation by means of a global international organization of social and behavioral scientists and social and behavioral science organizations, encouraging multidisciplinary and interdisciplinary cooperation among the members of the ISSC.

International Society for Developmental Psychobiology  
<http://www.oswego.edu/isdp/>

The purposes of the International Society for Developmental Psychobiology are to (a) promote and encourage research on the development of behavior in all organisms including humans, with special attention to the effects of biological factors operating at any level of organization; (b) facilitate communication of research results and theory in the area of developmental psychobiology through the use of both professional and popular printed media and through the presentation of papers at meetings of the society; and (c) foster application of the valid findings of research to human affairs in a way beneficial to humankind.

International Society of Behavioral Medicine  
www.isbm.miami.edu

The International Society of Behavioral Medicine (ISBM) is a federation of national societies whose goal is to serve the needs of all health-related disciplines concerned with issues relevant to behavioral medicine. Each national society includes both biomedical and behavioral scientists.

MEDLINEplus  
http://medlineplus.gov/

MEDLINEplus is a Web site with authoritative consumer health information from the National Institutes of Health and others.

MEDLINE/PubMed  
www.ncbi.nih.gov/entrez/query.fcgi

MEDLINE/PubMed is a database with references, primarily from MEDLINE, to journal articles in life sciences with a concentration on articles in the biomedical field.

The Metanexus Institute  
3624 Market Street, Suite 301  
Philadelphia, PA 19104  
Telephone: 215-789-2200  
www.metanexus.net

The Metanexus Institute advances research, education, and outreach on the constructive engagement of science and religion. It seeks to create an enduring intellectual and social movement by collaborating with persons and communities from diverse religious traditions and scientific disciplines.

National Academy of Neuropsychology  
2121 South Oneida Street, Suite 550  
Denver, CO 80224-2594

Telephone: 303-691-3694  
http://www.nanonline.org/

The National Academy of Neuropsychology is a professional society that includes clinicians, scientist practitioners, and researchers interested in neuropsychology.

National Academy of Sciences  
500 Fifth Street, N.W.  
Washington, DC 20001  
Telephone: 202-334-2000  
http://www4.nationalacademies.org/nas/nashome.nsf

The National Academy of Sciences (NAS) is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. The academy is governed by a council composed of 12 members (councilors) and five officers, elected from among the academy membership. The council is responsible to the membership for the activities undertaken by the organization and for the corporate management of the National Academy of Sciences, a corporation created by act of Congress that also includes the National Academy of Engineering (NAE), the Institute of Medicine (IOM), and the National Research Council (NRC). Collectively, these organizations are called the National Academies.

National Cancer Institute  
6116 Executive Boulevard, MSC 8322  
Bethesda, MD 20892-8322  
Telephone: 1-800-422-6237  
www.nci.nih.gov/

The National Cancer Institute (NCI) leads a national effort to reduce the burden of cancer morbidity and mortality. Its goal is to stimulate and support scientific discovery and its application to achieve a future when all cancers are uncommon and easily treated. Through basic and clinical biomedical research and training, NCI conducts and supports programs to understand the causes of cancer; prevent, detect, diagnose, treat, and control cancer; and disseminate information to the practitioner, patient, and public.

National Center for Complementary and Alternative Medicine  
Bethesda, MD 20892  
Telephone: 1-888-644-6226  
www.nccam.nih.gov/

The National Center for Complementary and Alternative Medicine (NCCAM) is dedicated to exploring complementary and alternative medical (CAM) practices in the context of rigorous science, training CAM researchers, and disseminating authoritative information.

National Center for Research Resources  
One Democracy Plaza, Room 984  
6701 Democracy Boulevard, MSC 4874  
Bethesda, MD 20892-4874  
Telephone: 301-435-0888  
[www.ncrr.nih.gov/](http://www.ncrr.nih.gov/)

The National Center for Research Resources (NCRR) advances biomedical research and improves human health through research projects and shared resources that create, develop, and provide a comprehensive range of human, animal, technological, and other resources. NCRR's support is concentrated in four areas: biomedical technology, clinical research, comparative medicine, and research infrastructure.

National Center on Minority Health and Health Disparities  
6707 Democracy Boulevard, Suite 800, MSC 5465  
Bethesda, MD 20892-5465  
Telephone: 301-402-1366  
[www.ncmhd.nih.gov/](http://www.ncmhd.nih.gov/)

The mission of the National Center on Minority Health and Health Disparities (NCMHD) is to promote minority health and to lead, coordinate, support, and assess the National Institutes of Health effort to reduce and ultimately eliminate health disparities. In this effort, NCMHD will conduct and support basic, clinical, social, and behavioral research; promote research infrastructure and training; foster emerging programs; disseminate information; and reach out to minority and other health disparity communities.

National Heart, Lung, and Blood Institute  
Bethesda, MD 20892  
Telephone: 301-592-8573  
[www.nhlbi.nih.gov/](http://www.nhlbi.nih.gov/)

The National Heart, Lung, and Blood Institute (NHLBI) provides leadership for a national program in diseases of the heart, blood vessels, lung, and blood; blood resources; and sleep disorders. NHLBI plans, conducts, fosters, and supports an integrated and coordinated program of basic research, clinical investigations and trials, observational studies, and demonstration and education projects.

National Human Genome Research Institute  
[www.nhgri.nih.gov/](http://www.nhgri.nih.gov/)

The National Human Genome Research Institute (NHGRI) supports the National Institutes of Health component of the Human Genome Project, a worldwide research effort designed to analyze the structure of human DNA and determine the location of the estimated 30,000 to 40,000 human genes.

National League for Nursing  
61 Broadway  
New York, NY 10006  
Telephone: 1-800-669-1656 or 212-363-5555  
<http://www.nln.org/>

The National League for Nursing advances quality nursing education that prepares the nursing workforce to meet the needs of diverse populations in an ever-changing health care environment.

National Institute of Allergy and Infectious Diseases  
Building 31, Room 7A-50, MSC 2520  
31 Center Drive  
Bethesda, MD 20892-2520  
[www.niaid.nih.gov/](http://www.niaid.nih.gov/)

National Institute of Allergy and Infectious Diseases (NIAID) research strives to understand, treat, and ultimately prevent the myriad infectious, immunologic, and allergic diseases that threaten millions of human lives.

National Institute of Arthritis and  
Musculoskeletal and Skin Diseases  
1 AMS Circle  
Bethesda, MD 20892-3675  
Telephone: 301-495-4484  
[www.niams.nih.gov/](http://www.niams.nih.gov/)

The National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) supports research into the causes, treatment, and prevention of arthritis and musculoskeletal and skin diseases, the training of basic and clinical scientists to carry out this research, and the dissemination of information on research progress in these diseases.

National Institute of Child Health and Human  
Development  
Building 31, Room 2A32, MSC 2425  
31 Center Drive  
Bethesda, MD 20892-2425  
[www.nichd.nih.gov/](http://www.nichd.nih.gov/)

National Institute of Child Health and Human Development (NICHD) research on fertility, pregnancy, growth, development, and medical rehabilitation strives to ensure that every child is born healthy and wanted and grows up free from disease and disability.

National Institute of Dental and Craniofacial Research  
Bethesda, MD 20892-2190  
Telephone: 301-496-4261  
[www.nidcr.nih.gov/](http://www.nidcr.nih.gov/)

The National Institute of Dental and Craniofacial Research (NIDCR) provides leadership for a national research program designed to understand, treat, and ultimately prevent the infectious and inherited craniofacial-oral-dental diseases and disorders that compromise millions of human lives.

National Institute of Diabetes and Digestive and Kidney Diseases  
Building 31, Room 9A04, MSC 2560  
Center Drive  
Bethesda, MD 20892  
[www.niddk.nih.gov/](http://www.niddk.nih.gov/)

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) conducts and supports basic and applied research and provides leadership for a national program in diabetes, endocrinology, and metabolic diseases; digestive diseases and nutrition; and kidney, urologic, and hematologic diseases. Several of these diseases are among the leading causes of disability and death; all seriously affect the quality of life of those who have them.

National Institutes of Health  
9000 Rockville Pike  
Bethesda, MD 20892  
[www.nih.gov/](http://www.nih.gov/)

The National Institutes of Health (NIH) is the steward of medical and behavioral research for the United States. Its mission is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. The goals of the agency are as follows: (1) foster fundamental creative discoveries, innovative research strategies, and their applications as a basis to advance significantly the nation's capacity to protect and improve health; (2) develop, maintain, and renew scientific human and physical resources that will assure the nation's capability to prevent disease;

(3) expand the knowledge base in medical and associated sciences in order to enhance the nation's economic well-being and ensure a continued high return on the public investment in research; and (4) exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science.

National Institute of Mental Health  
6001 Executive Boulevard, Room 8184, MSC 9663  
Bethesda, MD 20892  
Telephone: 301-443-4513  
[www.nimh.nih.gov/](http://www.nimh.nih.gov/)

The National Institute of Mental Health (NIMH) provides national leadership dedicated to understanding, treating, and preventing mental illnesses through basic research on the brain and behavior, and through clinical, epidemiological, and services research.

National Institute of Neurological Disorders and Stroke  
P.O. Box 5801  
Bethesda, MD 20824  
Telephone: 1-800-352-9424  
[www.ninds.nih.gov/](http://www.ninds.nih.gov/)

The mission of the National Institute of Neurological Disorders and Stroke (NINDS) is to reduce the burden of neurological diseases—a burden borne by every age group, every segment of society, and people all over the world. To accomplish this goal, the NINDS supports and conducts research, both basic and clinical, on the normal and diseased nervous system, fosters the training of investigators in the basic and clinical neurosciences, and seeks better understanding, diagnosis, treatment, and prevention of neurological disorders.

National Institute of Nursing Research  
[www.ninr.nih.gov/](http://www.ninr.nih.gov/)

The National Institute of Nursing Research (NINR) supports clinical and basic research to establish a scientific basis for the care of individuals across the life span—from the management of patients during illness and recovery to the reduction of risks for disease and disability; the promotion of healthy lifestyles; the promotion of quality of life in those with chronic illness; and the care for individuals at the end of life. This research may also include families within a community context, and it also focuses on the special needs of at-risk and underserved populations, with an emphasis on health disparities.



National Institute on Aging  
 Building 31, Room 5C27, MSC 2292  
 31 Center Drive  
 Bethesda, MD 20892  
 Telephone: 301-496-1752  
[www.nia.nih.gov/](http://www.nia.nih.gov/)

The National Institute on Aging (NIA) leads a national program of research on the biomedical, social, and behavioral aspects of the aging process; the prevention of age-related diseases and disabilities; and the promotion of a better quality of life for all older Americans.

National Institute on Alcohol Abuse and Alcoholism  
 6000 Executive Boulevard, Willco Building  
 Bethesda, MD 20892-7003  
[www.niaaa.nih.gov/](http://www.niaaa.nih.gov/)

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) conducts research focused on improving the treatment and prevention of alcoholism and alcohol-related problems to reduce the enormous health, social, and economic consequences of this disease.

National Institute on Deafness and  
 Other Communication Disorders  
 MSC 2320  
 31 Center Drive  
 Bethesda, MD 20892-2320  
[www.nidcd.nih.gov/](http://www.nidcd.nih.gov/)

The National Institute on Deafness and Other Communication Disorders (NIDCD) conducts and supports biomedical research and research training on normal mechanisms as well as diseases and disorders of hearing, balance, smell, taste, voice, speech, and language that affect 46 million Americans.

National Institute on Drug Abuse  
[www.nida.nih.gov/](http://www.nida.nih.gov/)

The National Institute on Drug Abuse (NIDA) leads the nation in bringing the power of science to bear on drug abuse and addiction through support and conduct of research across a broad range of disciplines and rapid and effective dissemination of results of that research to improve drug abuse and addiction prevention, treatment, and policy.

National Library of Medicine  
 8600 Rockville Pike  
 Bethesda, MD 20894  
[www.nlm.nih.gov/](http://www.nlm.nih.gov/)

The National Library of Medicine (NLM) collects, organizes, and makes available biomedical science information to investigators, educators, and practitioners and carries out programs designed to strengthen medical library services in the United States. Both health professionals and the public use its electronic databases, including MEDLINE and MEDLINEplus, extensively throughout the world.

National Science Foundation  
 4201 Wilson Boulevard  
 Arlington, VA 22230  
 Telephone: 703-292-5111  
[www.nsf.gov](http://www.nsf.gov)

The National Science Foundation (NSF) is an independent agency of the U.S. government. The NSF's mission is to promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

Neurobehavioral Teratology Society  
<http://www.nbts.org/>

The purpose of the Neurobehavioral Teratology Society (NBTS) is to understand the behavioral and developmental alterations that result from genetic and environmental perturbations of the nervous system during the pre- and perinatal period. NBTS is also focused on communicating such findings to physicians, scientists, public health officials, and the general public to promote awareness and lessen the risks for teratologic occurrences in the population at large. NBTS also has a special focus of educating scientists in the appropriate methodology for conducting teratologic research.

Office of Behavioral and Social Sciences Research  
<http://obssr.od.nih.gov/>

The Office of Behavioral and Social Sciences Research (OBSSR) mission is to stimulate behavioral and social sciences research throughout the National Institutes of Health (NIH) and to integrate these areas of research more fully into others of the NIH health research enterprise, thereby improving our understanding, treatment, and prevention of disease.

Office of Disease Prevention and Health Promotion  
 200 Independence Avenue S.W., Room 738G  
 Washington, DC 20201  
 Telephone: 202-205-8611  
[www.odphp.osophs.dhhs.gov/](http://www.odphp.osophs.dhhs.gov/)

Created by Congress in 1976, the Office of Disease Prevention and Health Promotion (ODPHP) plays a vital role in developing and coordinating a wide range of national disease prevention and health promotion strategies.

Psychology.info  
<http://psychology.info/>

Psychology.info is the easiest starting point for psychology and mental health information on the Internet. The links are handpicked psychology destinations with reliable information and include recent headlines in the field of psychology.

PsychoNeuroImmunology Research Society  
 6619 Palma Lane  
 Morton Grove, IL 60053  
[www.pnirs.org](http://www.pnirs.org)

The PsychoNeuroImmunology Research Society (PNIRS) is an international organization for researchers in a number of scientific and medical disciplines, including psychology, neurosciences, immunology, pharmacology, psychiatry, behavioral medicine, infectious diseases, and rheumatology, who are interested in interactions between the nervous system and the immune system, and the relationship between behavior and health.

Psychonomic Society  
 1710 Fortview Road  
 Austin, TX 78704  
 Telephone: 512-462-2442  
<http://www.psychonomic.org/>

The Psychonomic Society promotes the communication of scientific research in psychology and allied sciences. Its members are qualified to conduct and supervise scientific research, must hold a PhD degree or equivalent, and must have published significant research other than the doctoral dissertation.

Psych web  
[www.psywww.com/](http://www.psywww.com/)

Psych web is a Web site containing lots of psychology-related information for students and teachers of psychology.

Public Health Institute  
 2001 Addison Street, Second Floor  
 Berkeley, CA 94704-1103  
 Telephone: 510-644-8200  
<http://www.phi.org/>

The Public Health Institute (PHI) is an independent, nonprofit organization dedicated to promoting health, well-being, and quality of life for people throughout California, across the nation, and around the world. As one of the largest and most comprehensive public health organizations in the nation, the PHI focuses its efforts in two distinct but complementary ways. PHI promotes and sustains independent, innovative research, training, and demonstration programs—many in collaboration with the private health care system and community-based organizations. PHI also serves as a partner with government to support its role in assessment, policy development, and assurance.

Research Society on Alcoholism  
 4314 Medical Parkway, Suite 12  
 Austin, TX 78756-3332  
 Telephone: 512-454-0022  
<http://www.rsoa.org/>

The Research Society on Alcoholism (RSA) serves as a meeting ground for scientists in the broad areas of alcoholism and alcohol-related problems. The society promotes research and the acquisition and dissemination of scientific knowledge.

Robert Wood Johnson Foundation  
 P.O. Box 2316  
 Princeton, NJ 08543  
 Telephone: 1-888-631-9989  
[www.rwjf.org](http://www.rwjf.org)

The Robert Wood Johnson Foundation is the largest philanthropy devoted exclusively to health and health care in the United States. The Robert Wood Johnson Foundation seeks to improve the health and health care of all Americans. To achieve the most impact with its funds, it prioritizes grants into four goal areas: to ensure that all Americans have access to quality health care at reasonable cost; to improve the quality of care and support for people with chronic health conditions; to promote healthy communities and lifestyles; and to reduce the personal, social, and economic harm caused by substance abuse—tobacco, alcohol, and illicit drugs.

Science.gov  
[www.science.gov](http://www.science.gov)

Science.gov is a gateway to authoritative selected science information provided by U.S. government agencies, including research and development results. It contains reliable information resources selected by

the respective agencies as their best science information. Two major types of information are included—selected authoritative science Web sites and databases of technical reports, journal articles, conference proceedings, and other published materials. The selected Web sites can be explored from the science.gov homepage. The Web pages and the databases can be searched individually or simultaneously from the search page.

Social Sciences Institute  
North Carolina AT&T University  
Charles H. Moore Building, A-35  
Greensboro, NC 27411  
[www.ssi.nrcs.usda.gov/ssi/](http://www.ssi.nrcs.usda.gov/ssi/)

The Social Sciences Institute (SSI) integrates customer opinion and fieldwork with science-based analysis to discover how social and economic aspects of human behavior can be applied to natural resource conservation programs, policies, and activities.

Society of Behavioral Medicine  
7600 Terrace Avenue, Suite 203  
Middleton, WI 53562  
Telephone: 608-827-7267  
[www.sbm.org](http://www.sbm.org)

The Society of Behavioral Medicine (SBM) is the nation's largest multidisciplinary organization dedicated to advancing the science and practice of behavioral medicine. Behavioral medicine is defined as an interdisciplinary field dedicated to improving individual and population health through the integration of scientific knowledge from the behavioral, biomedical, social, and public health disciplines and through the application of this evidence-based knowledge to improve prevention, treatment, rehabilitation, chronic illness management, quality of life, and coping during all phases of the life cycle.

Society for Behavioral Neuroendocrinology  
4327 Ridge Road  
Palmyra, VA 22963  
[www.sbn.org](http://www.sbn.org)

The Society for Behavioral Neuroendocrinology (SBN) is a scientific society committed to understanding interactions between behavior and neuroendocrine function to advance understanding of behavioral neuroendocrinology. The society promotes exchanges between investigators approaching this problem from diverse perspectives. Researchers working in

laboratory, field, or clinical settings and on invertebrates, vertebrates, or cell lines both in vitro and in vivo are encouraged to join the society. Scientists interested in behavioral ecology, animal behavior, biological timing, neurosciences, endocrinology, development, cell biology, and genetics are all welcome. One's research need not explicitly employ behavioral techniques as long as the research is relevant to behavior. Similarly, behavioral research need not employ neuroendocrine techniques, but only be related to neuroendocrine function. Integrating cellular and molecular concepts into a functional framework is crucial to understanding how neuroendocrine function affects behavior and is, in turn, affected by behavior.

Society for Medical Decision Making  
1211 Locust Street  
Philadelphia, PA 19107  
Telephone: 215-545-7697  
<http://www.smdm.org/>

The Society for Medical Decision Making's mission is to improve health outcomes through the advancement of proactive systematic approaches to clinical decision making and policy formation in health care by providing a scholarly forum that connects and educates researchers, providers, policymakers, and the public.

Society for Neuroscience  
11 Dupont Circle, N.W., Suite 500  
Washington, DC 20036  
Telephone: 202-462-6688  
[www.sfn.org](http://www.sfn.org)

The Society for Neuroscience (SfN) is a nonprofit membership organization of basic scientists and physicians who study the brain and nervous system. Neuroscience includes the study of brain development, sensation and perception, learning and memory, movement, sleep, stress, aging, and neurological and psychiatric disorders. It also includes the molecules, cells, and genes responsible for nervous system functioning.

Society of Pediatric Psychology  
P.O. Box 170231  
Atlanta, GA 30317  
[www.apa.org/divisions/div54/](http://www.apa.org/divisions/div54/)

The Society of Pediatric Psychology (SPP) provides a forum for scientists and professionals interested in the health care of children, adolescents, and

their families. The field of pediatric psychology is defined by the concerns of psychologists and allied professionals who work in interdisciplinary settings such as children's hospitals, developmental clinics, and pediatric or medical group practices, as well as traditional clinical child or academic arenas. It focuses on the rapidly expanding role of behavioral medicine and health psychology in the care of children, adolescents, and their families. As Division 54 of the American Psychological Association (APA), it provides an annual forum for research and practice presentations at the annual APA convention.

Society for Prevention Research  
1300 I Street, N.W., Suite 250 West  
Washington, DC 20005  
Telephone: 202-216-9670  
<http://info@preventionresearch.org>

One of the primary goals of the Society for Prevention Research (SPR) is to create a scientific, multidisciplinary forum for prevention science, and a concerted effort is being made to invite investigators whose research specialties are not represented in the current membership to join SPR.

Society for Psychophysiological Research  
1010 Vermont Avenue, N.W., Suite 1100  
Washington, DC 20005-4907  
Telephone: 202-393-4810  
[www.wlu.edu/~spr/](http://www.wlu.edu/~spr/)

The Society for Psychophysiological Research is an international scientific society with worldwide membership. The purpose of the society is to foster research on the interrelationships between the physiological and psychological aspects of behavior.

Society for Public Health Education  
750 First Street N.E., Suite 910  
Washington, DC 20002-4242  
Telephone: 202-408-9804  
<http://www.sophe.org/>

The Society for Public Health Education (SOPHE) is an independent, international professional association made up of a diverse membership of health education professionals and students. The society promotes healthy behaviors, healthy communities, and healthy environments through its membership, its network of local chapters, and its numerous partnerships with other organizations. With its primary focus on public health education, SOPHE provides leadership

through a code of ethics; standards for professional preparation, research, and practice; professional development; and public outreach.

Society for Research in Child Development  
University of Michigan  
3131 South State Street, Suite 302  
Ann Arbor, MI 48108-1623  
<http://www.srkd.org/>

The purposes of the Society for Research in Child Development are to promote multidisciplinary research in the field of human development, to foster the exchange of information among scientists and other professionals of various disciplines, and to encourage applications of research findings. The society is a multidisciplinary, not-for-profit, professional association with a membership of approximately 5,500 researchers, practitioners, and human development professionals from more than 50 countries.

Society for Research on Nicotine and Tobacco  
7600 Terrace Avenue, Suite 203  
Middleton, WI 53562, USA  
Telephone: 608-836-3787  
[www.srnt.org/](http://www.srnt.org/)

The mission of the Society for Research on Nicotine and Tobacco (SRNT) is to stimulate the generation of new knowledge concerning nicotine in all its manifestations—from molecular to societal.

Society for Stimulus Properties of Drugs  
<http://www.sspd.org.uk/>

The Society for Stimulus Properties of Drugs (SSPD) supports the use of drug discrimination methods and some related approaches in teaching and research on psychoactive drugs. Many of these drugs have medical uses in psychiatry and neurology, whereas others have no recognized medical uses but may be under development for such use, or are subject to abuse. Both licit and illicit substances are included. Membership of SSPD is open to individuals with bachelor or higher degrees in relevant subjects and with a genuine interest in the field.

Substance Abuse and Mental Health Services Agency  
5600 Fishers Lane  
Rockville, MD 20857  
[www.samhsa.gov/](http://www.samhsa.gov/)

The Substance Abuse and Mental Health Services Agency (SAMHSA) is the federal agency charged with improving the quality and availability of prevention, treatment, and rehabilitative services in order to reduce illness, death, disability, and cost to society resulting from substance abuse and mental illnesses.

U.S. National Committee of the International Union of  
Psychological Science  
<http://www.iupsys.org/>

The International Union of Psychological Science serves as an umbrella international voice supporting “the development of psychological science, whether biological or social, normal or abnormal, pure or applied.” It has national members from close to 70 countries, and works to represent the full breadth of psychology as a profession and as a science.

Women’s Health Initiative  
[www.nhlbi.nih.gov/whi/](http://www.nhlbi.nih.gov/whi/)  
[www.whi.org/](http://www.whi.org/)

The Women’s Health Initiative (WHI) is one of the largest preventive studies of its kind in the United States. The WHI is a 15-year research program that is composed of three major components: a randomized controlled clinical trial of promising but unproven approaches to prevention, an observational study to identify predictors of disease, and a study of community approaches to developing healthful behaviors.

World Health Organization  
Avenue Appia 20  
1211 Geneva 27, Switzerland  
Telephone: (+ 41 22) 791 21 11  
<http://www.who.int>

The World Health Organization (WHO), the United Nations specialized agency for health, was established in 1948. WHO’s mission is the attainment by all peoples of the highest possible level of health. Health is defined in WHO’s constitution as a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

# Appendix B

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